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ABSTRACT

The Division of Science Resources Studies (SRS) of the National Science Foundation has a legislatively mandated responsibility for the collection, compilation, and analyses of information related to science and technology, inputs, outputs, and impact. This constitutes a broad charter requiring diverse activities. The products of these activities are of utility to a heterogeneous clientele, varying from governmental science and technology policymakers to institutional managers and research analysts. This compilation of summaries has been prepared to provide various SRS users with a rapid overview of all current and recently completed SRS projects. All projects summarized in this publication were either ongoing or completed during FY 1982. The summaries include information on objectives, findings, methodology, authorship, and resulting publications and availability. Projects are organized in the following groups: (1) overview projects; (2) human resources (scientists, engineers, technicians), including supply, utilization, and special studies; (3) funding of science and technology, including government, industry, academic organizations (universities, colleges, and other non-profit organizations); and (4) outputs and impacts. Intramural (SRS) and extramural publications are listed in two appendices. (Author/JN)

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SE 039 602

FOREWORD

The Division of Science Resources Studies (SRS) engages in numerous activities to produce information and analyses pertinent to a fuller understanding of the magnitude, characteristics, and dynamics of the technical resources of the United States. Projects that produce this information are either staffed intramurally or consist of extramural activities supported through grants and contracts. The information generated is of prime interest to a variety of individuals, varying from science and technology policymakers to researchers. A need has been expressed for a compact reference volume that permits a rapid overview of all of the projects carried out by the Division and that provies a summary of each endeavor. This publication is responsive to such a need and is the second volume of an annual series. It presents an overview of the many facets that are being illuminated by SRS efforts. It also furnishes sufficient information on project objectives, methods, results, and references to facilitate user selection of projects for further investigation. As in any new effort, the format by which the information is presented is far from perfect, and constructive criticisms and suggestions are most welcome.

Charles E. Falk, Director
Division of Science Resources
Studies
Directorate for Scientific,
Technological, and
International Affairs

September 1982

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NOTES

The Division of Science Resources Studies (SRS) of the National Science Foundation has a legislatively mandated responsibility for the collection, compilation, and analyses of information related to science and technology, inputs, outputs, and impacts. This constitutes a broad charter requiring a large number of diverse activities. The products of these activities are of utility to a heterogeneous clientele, varving from governmental science and technology policymakers to institutional managers and research analysts. Their interest extends not only to the actual results of the various surveys and studies, but also to the nature of projects that are still ongoing. Consequently, this compilation of summaries has been prepared to provide these various SRS users with a rapid overview of all currently ongoing and recently completed SRS projects. Summary publications are issued on an annual basis.

All projects summarized in this publication were either ongoing or completed during FY 1982. The summaries include information on objectives, findings, methodology, authorship, and resulting publications. They are organized in major substantive groups. Projects noted as being intramural are those carried out directly by the staff of the Division and include efforts sponsored by the Division but carried out in part by other Government agencies and by contractors. Projects noted as being extramural are those for which institution(s) and/or principal investigators are identified, and are supported through grants and contracts.

Publications are identified in the three formats used by SRS: Highlights, Detailed Statistical Tables, and Reports. A Science Resources Studies Highlights is normally restricted to four pages and presents the essence of the analyzed data in brief statements and in graphic and tabular form. As soon as feasible after the Highlights has been issued, survey data are released as Detailed Statistical Tables for the reference and convenience of other analysts and researchers. The complete analysis is then developed and published in a Final Report. When the subject is one of an ad hoc nature, the publication is identified as a Special Report. The SRS Editorial and Inquiries Unit (EIU) maintains a mailing list by which users of SRS publications automatically receive copies of Highlights and Reports. Detailed Statistical Tables must be ordered individually. A listing of all SRS publications issued since 1972 is included as the appendix of this publication.

SECTION I. OVERVIEWS

Project:

Academic Science, 1972-81

Objective:

To provide consolidated biennial analyses of academic R&D expenditures, the utilization of academic scientists and engineers, and the characteristics of the graduate science/engineering (S/E) student population.

Method:

The report presents analyses based on data selected primarily from the following three academic surveys: (1) Scientific and Engineering Expenditures at Universities and Colleges, FY 1972 through FY 1980; (2) Scientific and Engineering Personnel Employed at Universities and Colleges, January 1973 through 1980; and (3) Graduate Science Student Support and Postdoctorates, Fall 1974 through 1980.

Major Findings:

One out of every ten R&D dollars was spent by universities and colleges in 1980 and one-half of the $6 billion devoted to basic research was performed in academia. Between 1972 and 1980 R&D expenditures by universities grew at an average rate of 11% per year in real-dollar terms, but estimates for 1981 indicate a decline of 4% in such expenditures in real dollars. Academic employment of scientists and engineers rose at a yearly rate of 3%. The number of full- and part-time S/E professionals employed rose 3% yearly between 1978 and 1980, about the same as the growth rate for the entire 1973-80 period. Graduate S/E enrollment rose about 2% per year since fall 1977 and was up nearly 3% by 1980.

Responsible SRS Organizaton:

R&D Economic Studies Section/Universities and Nonprofit Institutions Studies Group

Institution/Principal Investigator:

[Intramural]

Availability:

Academic Science: 1972-81. R&D Funds, Scientists and Engineers, Graduate Enrollment and Support, Final Report, NSF 81-316, March 1982, National Technical Information Service, Springfield, Virginia 22161, PB 82-242439, $10.50 (paper copy), $4.00 (microfiche); also available from SRS/Editorial and Inquiries Unit.

Project:

Science and Engineering (S/E) Personnel, 1982

Objective:

To provide a comprehensive overview of current employment, supply patterns, and the dynamics of the labor market for all U.S. scientists and engineers.

Method:

Based on NSF survey data and secondary data sources. Report generally is descriptive, with some analytical treatment of data.

Major Findings:

Job opportunities for scientists and engineers in the United States continued to expand between 1978 and 1980 as employment in S/E jobs increased by 7% to 2.6 million. Fueled by rapid growth among computer specialists and life scientists, employment of scientists in S/E activities grew more rapidly than the comparable employment of engineers between 1978 and 1980 (10% versus 3%). Between 1978 and 1980, employment of women rose more than 5 times faster than employment of men (32% versus 6%). Despite this dramatic growth, women represented about 13% of the S/E work force in 1980, compared to about 40% of all professional and related workers. Employment of members of minority groups who are scientists or engineers grew more rapidly than employment of whites between 1978 and 1980 (17% for blacks, 11% for Asians, and 7% for whites).

Responsible SRS Organization:

Scientific and Technical Personnel Studies Section

Institution/Principal Investigator:

[Intramural]

Availability:

Science and Engineering Personnel: A National Overview, NSF 82-318, October 1982, will be available from the Supt. of Documents, U.S. Government Printing Office, Washington, D.C.; National Technical Information Service, Springfield, Virginia 22161; and from SRS/Editorial and Inquiries Unit.

Project:

Science and Technology Resources, 1981

Objective:

To present an overview of U.S. science and technology resources based on the most current information available to the Foundation.

Method:

Information originated from a series of systematic, regularly recurring surveys of institutions and individual scientists and engineers. The data include R&D funding by source of funds and performer, character of work (basic research, applied research, and development), national objectives, and international comparisons. Topics concerning science and engineering (S/E) personnel include type of activity, employment opportunities, S/E labor market dynamics, and current and future S/E labor market conditions.

Major Findings:

R&D expenditures in the United States totaled $61.1 billion in 1980, an increase of 13% over the previous year (4% in constant dollars). For 1981, the overall increase in the Nation's R&D expenditures was estimated at 13% (3% in constant dollars). S/E employment in 1980 increased by about 10% over 1978, in contrast with the 3% rate of the total work force. The S/E unemployment rate fell from 3% to 1.4% between 1976 and 1978 and remained essentially unchanged through mid-1980.

Responsible SRS Organizations:

R&D Economic Studies and Scientific and Technical Personnel Studies Sections

Institution/Principal Investigator:

[Intramural]

Availability:

National Patterns of Science and Technology Resources, 1981, Report, NSF 81-311, April 1981, Supt. of Documents, U.S. Government Printing Office, Washington, D.C. 20402, Stock Number 038-000-00489-1, Price $4.75; National Technical Information Service, Springfield, Virginia 22161, PB 82-257403, $10.50 (paper copy), $4.00 (microfiche); also available from SRS/Editorial and Inquiries Unit.

Project:

Science and Technology Resources, 1982

Objective:

To present an overview of U.S. science and technology resources based on the most current information available to the Foundation.

Method:

Information originated from a series of systematic, regularly recurring surveys of institutions and individual scientists and engineers. The data include R&D funding by source of funds and performer, character of work (basic research, applied research, and development), national objectives, and international comparisons. Topics concerning science and engineering (S/E) personnel include women and minorities, trends in employment, S/E labor market balance, and labor market dynamics.

Major Findings:

R&D expenditures in the United States totaled $69.8 billion in 1981, an increase of 12% over the previous year (3% in constant dollars). For 1982, the overall increase in the Nation's R&D expenditures was estimated at 11% (3% in constant dollars).

S/E employment in 1980 increased by 9% over 1978, in contrast with the 3% rate of the total work force. The S/E unemployment rate was less than 1% in 1979. In addition, fewer than 10% of those employed had jobs outside of science and engineering.

Responsible SRS Organizations:

R&D Economic Studies and Scientific and Technical Personnel Studies Sections

Institution/Principal Investigator:

[Intramural]

Availability:

National Patterns of Science and Technology Resources, 1982, Report, NSF 82-319, September 1982, Supt. of Documents, U.S. Government Printing Office, Washington, D.C. 20402, Stock Number 038-000-00512-0, $5.00; and will be available from the National Technical Information Service, Springfield, Virginia, and SRS/Editorial and Inquiries Unit.

Project:

Science and Technology Resources, 1983

Objective:

To present an overview of U.S. science and technology resources based on the most current information available to the Foundation.

Method:

Information originated from a series of systematic, regularly recurring surveys of institutions. The data were then aggregated by the four major sectors of the economy and included R&D funding by sources of funds and performer, character of work (basic research, applied research, and development), and international comparisons.

Major Findings:

R&D expenditures in the United States totaled an estimated $77.3 billion in 1979, an increase of 11% over the previous year (3% in constant dollars). For 1983, the overall increase in the Nation's R&D expenditures is estimated at 10% (4% in constant dollars).

Responsible SRS Organization:

R&D Economic Studies Section

Institution/Principal Investigator:

[Intramural]

Availability:

"National R&D Expenditures Expected to Reach $85 Billion in 1983," Highlights, NSF 82-311, June 11, 1982, available from SRS/Editorial and Inquiries Unit.

Project:

Science Indicators--1980

Objective:

To present quantitative indicators of the state of science and technology in the United States, supplementing but not supplanting the judgment of policymakers who are faced with specific science and technology issues.

Method:

The report draft was prepared in the SRS/Science Indicators Unit for review by a special committee of National Science Board members. Chapters were reviewed by 30 experts, and by R&D executives of other Federal agencies, and then issued by the full National Science Board as its 13th Annual Report.

Major Findings:

Science Indictors--1980 is the fifth in a series of similar reports by the National Science Board. It presents statistical indicators with relevant interpretation and explanation. Its seven chapters are:

1. International Science and Technology
2. Resources for Research and Development
3. Resources for Basic Research
4. Industrial R&D and Technological Progress
5. Scientific and Engineering Personnel
6. Public Attitudes Toward Science and Technology
7. Advances in Science

This report contains two chapters (numbers 6 and 7) that were not part of the previous Science Indicators report.

Responsible SRS Organization:

Science Indicators Unit

Institution/Principal Investigator:

[Intramural]

Availability:

Science Indicators--1980, NSB 81-1, Supt. of Documents, U.S. Government Printing Office, Washington, D.C. 20402, Stock Number 038-000-00493-0, $10.00, and from the Publications Office, Room 235, National Science Foundation, 1800 G Street, N.W., Washington, D.C. 20550.

Project:

U.S. Scientists and Engineers, 1980

Objective:

To provide estimates of the U.S. population of scientists and engineers, as well as of their demographic, educational, and employment characteristics.

Method:

The results of several surveys conducted by NSF's Scientific and Technical Personnel Characteristics System were synthesized to produce estimates as of mid-1980.

Major Findings:

It was estimated that in 1980 there were 2,964,000 scientists and engineers in the United States, of which 2,675,000 were employed. About 62% of the employed were located in business and industry and about 37% were involved in research and development including its management. Around 10% of the total were women, and Asians constituted the largest minority group.

Responsible SRS Organization:

Scientific and Technical Personnel Studies Section/Demographic Studies Group

Institution/Principal Investigator:

[Intramural]

Availability:

U.S. Scientists and Engineers, 1980, Detailed Statistical Tables, NSF 82-314, August 1982; will be available from the National Technical Information Service, Springfield, Virginia 22161, and from SRS/Editorial and Inquiries Unit.

SECTION II. HUMAN RESOURCES

A. Supply

1. New Supply

Project:

Bachelor's- and Master's-Degree Recipients, 1980

Objective:

To develop quantitative information on the demographic, educational, employment, and professional characteristics of the 1977/78 and 1978/79 bachelor's- and master's-degree recipients in science and engineering.

Method:

This 1980 NSF New Entrants Survey consisted of a sampling of about 7,000 baccalaureate- and 4,000 master's-degree holders for each of the two academic years. The survey was instituted in February 1980; data collection was completed in November of the same year, and was conducted for NSF by Westat, Inc.

Major Findings:

Over 97% of the bachelor's- and 99% of the master's-degree holders were either employed or were outside the labor force. Business/industry was the largest single employer for both groups. Over one-third of the bachelor's and one-fourth of the master's were women.

Responsible SRS Organization:

Scientific and Technical Personnel Studies Section/Demograhic Studies Group

Institution/Principal Investigator:

[Intramural]

Availability:

Data are available for inspection in the Scientific and Technical Personnel Studies Section/Demographic Studies Group. "Employment of Recent Science and Engineering (S/E) Graduates in S/E Fields Increased," Highlights, NSF 82-320, August 13, 1982, available from SRS/Editorial and Inquiries Unit, and Characteristics of Recent Science/Engineering Graduates: 1980, Detailed Statistical Tables, NSF 82-313, July 1982, National Technical Information Service, Springfield, Virginia 22161, PB 82-262478, $10.50 (paper copy), $4.00 (microfiche); also available from SRS/Editorial and Inquiries Unit.

Project:

The Doctorate Survey

Objective:

To collect calendar year information on characteristics and work plans of new doctorates through the Survey of Earned Doctorates and to maintain the computerized Doctorate Records File, which is virtually a complete listing of the more than 660,000 students who have received their doctorates since 1920.

Method:

Questionnaires are distributed to all individuals receiving doctorates, and are completed by them near the time of graduation. In recent years, response rates have been better than 95%. Nonrespondents to the questionnaire are represented in the data base through information obtained from public records such as official commencement programs. An award, which provides calendar year 1982 support for a continuing activity, was given in September 1981.

Because of the time phasing of this project, data are collected during one year, and then processed and published during the next. For the duration of this award the National Academy of Sciences will publish a report on doctorate recipients of the 1980/81 academic year. This report will be titled: Summary Report 1981. Doctorate Recipients From United States Universities. A report on doctorate recipients of the 1981/82 academic year is expected to be published in 1983.

Major Findings:

About 17,600 science and engineering (S/E) doctorates were produced in 1981, a decline of 7% since the peak reached in 1973. These 1981 S/E doctorates represented 56% of total 1981 doctorate production, the same level prevailing through the seventies. The number of women S/E doctorates (4,000) in 1981 was approximately double that for 1971. The field composition and job opportunities of new S/E doctorates also shifted between 1971 and 1981. The number of engineering and physical sciences doctorates declined by 30%, while the number of social and life sciences doctorates increased. In 1981 nonacademic employment opportunities were better than academic opportunities for new doctorates.

Responsible SRS Organization:

Scientific and Technical Personnel Studies Section/Supply and Education Analysis Group

Institution/Principal Investigator:

National Academy of Sciences/Peter D. Syverson

Availability:

"Science and Engineering Doctorate Production Increases in 1981; More New Ph. D.'s Seek Nonacademic Positions," Highlights, NSF 82-303, September 10, 1982, available from SRS/Editorial and Inquiries Unit. Detailed Statistical Tables will become available in fall 1982. Summary Report, 1981. Doctorate Recipients From United States Universities is available from the Commission on Human Resources, National Research Council, National Academy of Sciences, 2101 Constitution Avenue, N.W., Washington, D.C. 20418 and will be available from the National Technical Information Service, Springfield, Virginia 22161.

Project:

Graduate Science and Engineering (S/E) Enrollment, 1980

Objective:

To provide quantitative information by discipline on the characteristics of graduate S/E students and postdoctorates, with emphasis on their sources of support.

Method:

All graduate S/E departments in 305 master's- and 328 doctorate-granting institutions received the annual questionnaire for fall 1980 data. There were several elements: Major sources and types of full-time graduate students' support; graduate enrollment status (full- or part-time); level of study; citizenship; sex; and racial/ethnic origin. Data were also collected on support patterns of postdoctorates and on nonfaculty doctoral research staff. Responses were received from 98% of the institutions surveyed. The survey was closed out in July 1981.

Major Findings:

S/E graduate enrollment continued the annual 3% increase that has been recorded every year since 1975, exceeding 383,000 in 1980. The greatest enrollment surge was reported in the mathematical/computer sciences, growing by 11%, but engineering enrollment grew at about twice the rate of science enrollment as a whole (4% contrasted with 2%). In doctorate-granting institutions, 21% of the 1980 total full-time S/E graduate students were foreign and 33% were women.

Responsible SRS Organization:

R&D Economic Studies Section/Universities and Nonprofit Institutions Studies Group

Institution/Principal Investigator:

[Intramural]

Availability:

"Graduate Science/Engineering Enrollment Up 3% Between 1979 and 1980," Highlights, NSF 82-306, May 12, 1982, available from SRS/Editorial and Inquiries Unit, and Academic Science: Graduate Enrollment and Support, Fall 1980, Detailed Statistical Tables, NSF 81-330, January 1982, National Technical Information Service, Springfield, Virginia 22161, PB 82-263740, $16.50 (paper copy), $4.00 (microfiche); also available from SRS/Editorial and Inquiries Unit. Access to the public-use tapes and documentation for their use are described in the Data User Guide, May 1982, available from the RDESS/Universities and Nonprofit Institutions Studies Group.

Project:

Graduate Science and Engineering (S/E) Enrollment, 1981

Objective:

To provide quantitative information by discipline on the characteristics of graduate S/E students and postdoctorates, with emphasis on their sources of support.

Method:

All graduate S/E departments in 305 master's- and 328 doctorate-granting institutions received the annual questionnaires for fall 1981 data. There were several data elements: Major sources and types of full-time graduate students' support; graduate enrollment status (full- or part-time); level of study; citizenship; sex; and racial/ethnic origin. Data were also collected on support patterns of postdoctorates and on nonfaculty doctoral research staff. The survey was closed out in August 1982.

Major Findings:

NA

Responsible SRS Organization:

R&D Economic Studies Section/Universities and Nonprofit Institutions Studies Group

Institution/Principal Investigator:

[Intramural]

Availability:

It is anticipated that Detailed Statistical Tables will be published by late spring 1983 and will become available from SRS/Editorial and Inquiries Unit.

Project:

New Entrants to Science and Engineering, 1982

Objective:

To obtain the professional, employment, and educational characteristics of recipients of bachelor's and master's degrees in science and engineering in the classes of 1979/80 and 1980/81.

In order to identify a sample (22,000) of science and engineering (S/E) bachelor's and master's recipients, a two-stage sampling plan was utilized. The first stage consisted of sampling the universe of those institutions of higher education that grant S/E degrees. The second stage consisted of sampling the graduates of a particular institutional sample member. The resulting individual graduates received a mail questionnaire during the summer and fall 1982. The data collected focused on demographic, employment, and professional characteristics.

Major Findings:

NA

Responsible SRS Organization:

Scientific and Technical Personnel Studies Section/Demographic Studies Group

Institution/Principal Investigator:

Temple University/Dr. Koray Tanfer

Availability:

Characteristics of Scientists and Engineers in the 1982 New Entrants Survey has a tentative publishing date of December 1983.

Project:

Quality of Undergraduate and Graduate Students in Selected Science and Engineering (S/E) Fields

Objective:

To obtain information on changes in the quality of S/E students compared to (a) previous cohorts of S/E students and (b) current students in other fields.

Method:

The survey will be conducted by the Higher Education Panel of the American Council on Education. The Panel includes a stratified sample of universities and colleges. The survey instrument is scheduled for mailing in October 1982 to the undergraduate and graduate deans in a sample of 512 institutions.

Major Findings:

NA

Responsible SRS Organization:

Scientific and Technical Personnel Studies Section/Supply and Education Analysis Group

Institution/Principal Investigator:

American Council on Education/Frank J. Atelsek

Availability:

The survey report is expected to be available in spring 1983 from the Higher Education Panel, American Council on Education, One Dupont Circle, N.W., Washington, D.C. 20036.

Project:

Science and Engineering (S/E) Degrees, 1950-80

Objective:

To analyze current and long-term trends in the production of S/E degrees, and to provide a convenient reference book for information on S/E degrees during the period.

Method:

The data presented were collected by the National Center for Education Statistics (NCES), Department of Education, from about 1,900 degree-awarding institutions of higher education in annual surveys from 1950 through 1980. The NCES data, which are reported by discipline speciality, were reclassified into S/E field categories according to NSF usage.

Major Findings:

In 1979/80, S/E bachelor's and doctoral degrees increased about 1%, whereas the number of S/E master's degrees was virtually the same as in 1978/79. S/E degrees at all three levels, however, were well below the numbers reached in the early to mid seventies. Between 1950 and 1980, the percentage of S/E bachelor's degrees earned by women increased from 12% to 36%. During the same period, women increased their share of S/E master's degrees from 11% to 27%, and S/E doctoral degrees from 6% to 21%. Analyses of S/E degrees in relation to 22-year-olds in the population, in the appropriate age groups for each degree level are also presented.

Responsible SRS Organization:

Scientific and Technical Personnel Studies Section/Supply and Education Analysis Group

Institution/Principal Investigator:

[Intramural]

Availability:

"Trends in Science and Engineering Degrees, 1950 Through 1980," Highlights, NSF 81-320, October 7, 1981, available from SRS/Editorial and Inquiries Unit, and Science and Engineering Degrees: 1950-80. A Source Book, NSF 82-307, Special Report, July 1982, available from National Technical Information Service, Springfield, Virginia 22161, PB 83-100446, $9.00 (paper copy), $4.00 (microfiche); also available from SRS/Editorial and Inquiries Unit.

SECTION II. HUMAN RESOURCES

A. Supply

2. Other

Project:

Factors Influencing Career Choices

Objective:

To assess what is known about the process by which young people decide upon careers.

Method:

This report reviews published studies in the fields of psychology, sociology, and economics that relate to occupational choice. Results of a pilot NSF study on baccalaureate S/E production are also presented. Separate multiple regression equations were analyzed for eight science and engineering (S/E) fields (physical, biological, agricultural, methematical, computer, and social sciences; engineering; and psychology). Within an autoregressive degree cycle model, the influence of supply variables, e.g., previous S/E graduates, and demand variables, e.g., annual income, on the current level of baccalaureate production in a particular S/E field was assessed.

Major Findings:

Extensive research in the disciplines of psychology, sociology, and economics has produced a fairly complete picture of the influences affecting young people in choosing careers. The importance of factors such as family background, intellectual ability, and the incomes possible in various careers has been well established. Unfortunately, the results of the career choice studies from the three diffeent disciplines cannot readily be combined to form a comprehensive model for predicting future career choice patterns at the national level. The results of the NSF study reported here, however, do generally support previous studies that students at the bachelor's degree level do respond to market conditions in choosing a degree specialty in most S/E fields.

Responsible SRS Organization:

Scientific and Technical Personnel Studies Section/Supply and Education Analysis Group

Institution/Principal Investigator:

[Intramural]

Availability:

Factors Influencing Young People in Choosing Careers, Special Report, will be available from the National Technical Information Service, Springfield, Virginia 22161, and from SRS/Editorial and Inquiries Unit.

Project:

Foreign Participation in U.S. Science and Engineering Higher Education and Labor Markets

Objective:

To provide a comprehensive review of the increasing role of foreign nationals in U.S. science and engineering during the seventies with particular emphasis on graduate school enrollment, doctorate production, and postdoctorate participation.

Method:

The report analyzes trend statistics from several survey systems: (1) The Annual Survey of Foreign Students conducted by the Institute of International Education (IIE); (2) NSF's Survey of Graduate Science Students and Postdoctorates; (3) the Fall Enrollment and Compliance Report of Institutions of Higher Education compiled by the National Center for Education Statistics (NCES) of the Department of Education; and (4) the Survey of Earned Doctorates sponsored by SRS.

Major Findings:

The increased demand for U.S. training to meet foreign needs for skilled science and engineering (S/E) workers, coupled with accelerated recruitment of foreigners by U.S. institutions to augment domestic enrollment, have had a pronounced effect on both graduate training and doctorate production in the seventies. Enrollment of foreign students doubled and their proportion in graduate programs, particularly in S/E disciplines, rose steadily. Growth of foreign students was most dramatic in engineering and mathematical and computer sciences. One out of every five S/E doctorates granted by U.S. universities in 1979 was awarded to a foreign citizen. This growing prominence of foreign doctorate-holders could affect domestic labor markets for selected fields if many of them remain in this country. If current patterns continue throughout the eighties, as many as one-sixth of the 1990 U.S. engineering labor force might be foreigners.

Responsible SRS Organizations:

R&D Economic Studies and Scientific and Technical Personnel Studies Sections

Institution/Principal Investigator:

[Intramural]

Availability:

Foreign Participation in U.S. Science and Engineering Higher Education and Labor Markets, Final Report, NSF 81-316, December 1981, Supt. of Documents, U.S. Government Printing Office, Washington, D.C. 20402, Stock Number 038-000-00484-1, $4.50; National Technical Information Service, Springfield, Virginia 22161, PB 82-262452, $9.00 (paper copy), $4.00 (microfiche); also available from SRS/Editorial and Inquiries Unit.

Project:

The Master's Degree in Science and Engineering

Objective:

To collect data from universities offering master's degrees in science and engineering, concerning the nature of the degree, trends in degree issuance, subsequent employment and education patterns of degree recipients, and the role of the degree program at the institutions and departments.

Method:

Data already collected on trends of degrees were analyzed, and heads of 2,900 master's degree-granting departments were surveyed. Useable returns were received from 51% of those surveyed.

Major Findings:

Graduate department chairpersons attributed a variety of goals to their master's programs, the most important being the preparation for entry to doctoral programs and as terminal training for advancement to career paths.

Emphasis in master's programs varies by field, according to whether departments also offer the doctorate, and by institutional selectivity. Master's programs in engineering exhibit the clearest employment- and community-related orientations, and frequently differ markedly from humanities and from social and natural science programs. The practitioner orientation of engineering programs holds at both Ph. D. and non-Ph. D.-granting institutions. Thus, engineering programs should feel real concern about the future supply of college-level teachers in their fields.

Apparently, the declining academic labor market for humanists has affected the extent to which master's programs constitute a step toward the doctorate or qualify teachers for higher salaries. Even so, departments at doctorate-granting institutions maintain the traditional mission of producing future scholars and professors in the humanities. Social science master's programs place greater emphases on both employment and scholarship than do the other master's programs. Natural science departments emphasize the preparation of scholars and doctoral students. Serving local community needs or self-enrichment are the least likely goals of natural science master's programs, and departments are less likely than humanities, but more likely than social sciences and engineering, to view elementary/secondary teachers credentialing as part of their mission.

Responsible SRS Organization:

Scientific and Technical Personnel Studies Section/Utilization Studies Group

Institution/Principal Investigators:

Higher Education Research Institute/Lewis C. Solmon and Ann S. Biconti

Availability:

Why Only a Master's Degree? Its Meaning in a Time of Retrenchment, January 1981, National Technical Information Service, Springfield, Virginia 22161, PB 82-181512, $21.00 (paper copy), $4.00 (microfiche).

Project:

Neuroscience Personnel and Training

Objective:

To collect information from higher education institutions on the organizational structure used for graduate neuroscience training in 1981-82, on the faculty, postdoctorates, graduate students, and related education factors. Research on the nervous system has grown rapidly over the past decade, but there is a serious lack of information about the current status of manpower and training in the interdisciplinary neuroscience field.

Method:

The survey is being conducted by the Higher Education Panel of the American Council on Education. The Panel includes a stratified sample of universities and colleges. The survey was mailed in June 1982 to 259 doctorate-granting and independent medical schools.

Major Findings:

NA

Responsible SRS Organization:

Scientific and Technical Personnel Studies Section/Supply and Education Analysis Group

Institution/Principal Investigator:

American Council on Education/Frank J. Atelsek

Availability:

The survey report is expected to be available in January 1983 from the Higher Education Panel, American Council on Education, One Dupont Circle, N.W., Washington, D.C. 20036.

Project:

Undergraduate Student Credit Hours in Science, Engineering, and the Humanities, Fall 1980

Objective:

To develop baseline information about the amount and level of science, engineering, engineering technology, and humanities instruction currently provided at various types of institutions of higher education.

Method:

The survey was conducted by the Higher Education Panel of the American Council on Education. The Panel includes a stratified sample of universities and colleges. The questionnaire was mailed in July 1981 to 698 institutions, and the response rate was 81%. Survey results were weighted to represent the population of 2,723 institutions that enroll undergraduates.

Major Findings:

In the first half of academic year 1980/81, 49 million undergraduate student credit hours were taken in ten science, engineering, and engineering-technology fields in universities and colleges. Another 21 million were taken in four major fields of the humanities. Of the credit hours in science, engineering, and engineering technology, 35% were taken in universities, 36% in 4-year colleges, and 30% in 2-year colleges; 78% of the total were in lower-division courses.

Responsible SRS Organization:

Scientific and Technical Personnel Studies Section/Supply and Education Analysis Group

Institution/Principal Investigator:

American Council on Education/Frank J. Atelsek

Availability:

"Undergraduate Student Credit Hours in Science, Engineering, and the Humanities, Fall 1980," Higher Education Panel Report, No. 54, is available from the Higher Education Panel, American Council on Education, One Dupont Circle, N.W., Washington, D.C. 20036, and from the National Technical Information Service, Springfield, Virginia 22161, PB 82-240854, $9.00 (paper copy), $4.00 (microfiche).

SECTION II. HUMAN RESOURCES

B. Utilization

1. Sector

Project:

Academic Employment of Scientists and Engineers, 1981

Objective:

To provide annual quantitative information on professional science and engineering (S/E) personnel employed by universities and colleges.

Method:

Coordinators in 2,200 institutions with S/E programs received the questionnaire for the January 1981 survey. Data elements were level of educational attainment; discipline of employment; employment status (full- or part-time); sex; and total and R&D full-time equivalents. Responses were received from 83% of the doctorate-granting institutions, where two-thirds of the S/E professionals were employed. The survey was closed out in July 1981.

Major Findings:

S/E employment in higher education in 1981 continued its annual rise of 3% as it has over the past seven years, totaling more than 333,000 S/E professionals, two-thirds of whom were employed by doctorate-granting institutions. Over 20% of the academic S/E work force was employed part time. The greatest surge in S/E employment was recorded in mathematical/computer sciences (8%), with much of the growth attributable to part-timers.

Responsible SRS Organization:

R&D Economic Studies Section/Universities and Nonprofit Institutions Studies Group

Institution/Principal Investigator:

[Intramural]

Availability:

"Academic Science/Engineering Employment Increased 3% Between 1980 and 1981," Highlights, NSF 82-312, June 18, 1982, available from SRS/Editorial and Inquiries Unit, and Academic Science: Scientists and Engineers, January 1981, Detailed Statistical Tables, NSF 82-305, June 1982; National Technical Information Service, Springfield, Virginia 22161, PB 83-101873, $13.00 (paper copy), $4.50 (microfiche); also available from SRS/Editorial and Inquiries Unit. Access to the public-use tapes and documentation for their use are described in the Data User Guide, May 1982, available from the RDESS/Universities and Nonprofit Institutions Studies Group.

Project:

Academic Employment of Scientists and Engineers, 1982

Objective:

To provide annual quantitative information on professional science and engineering (S/E) personnel employed by universities and colleges.

Method:

Coordinators in 2,200 institutions with S/E programs received the questionnaire for the January 1982 survey. Data elements were level of educational attainment; discipline of employment; employment status (full- or part-time); sex; and total and R&D full-time equivalents. The survey was closed out in September 1982.

Major Findings:

NA

Responsible SRS Organization:

R&D Economic Studies Section/Universities and Nonprofit Institutions Studies Group

Institution/Principal Investigator:

[Intramural]

Availability:

It is anticipated that Detailed Statistical Tables will be published by fall 1983, and will become available from SRS/Editorial and Inquiries Unit.

Project:

A Rapid Industry Limited Response Survey Panel for Scientific and Technical Personnel Resources

Objective:

To acquire and disseminate information on the industrial labor market for scientific and technical personnel so that policy can be formulated rapidly to meet urgent needs.

Method:

NSF established an industry panel of company representatives whose opinions and access to information can provide qualitative and quantitative information that is not readily available from existing sources and who do so on a timely basis.

Major Findings:

The first survey, conducted in the fall of 1981, sought to identify the extent of reputed shortages of scientists and engineers. The survey found definite and likely shortages of persons trained in computer science; systems analysis; and electrical/electronic, petroleum, and computer engineering. A general balance between supply and demand was reported for chemical, industrial, and mechanical engineering and the earth sciences. Fields in which job applicants were in excess of need included physics, mathematics, chemistry, and civil engineering.

Responsible SRS Organization:

Scientific and Technical Personnel Studies Section/Utilization Studies Group

Institution/Principal Investigator:

[Intramural]

Availability:

"Labor Markets for New Science and Engineering Graduates in Private Industry," Highlights, NSF 82-310, June 9, 1982, available from SRS/Editorial and Inquiries Unit.

Project:

Scientists, Engineers, and Technicians in Private Industry

Objective:

To provide data on employment of scientists, engineers, and technicians in the private sector by occupation and industry of employment.

Method:

Annual surveys of employing establishments are conducted by State Employment Security agencies in cooperation with the Bureau of Labor Statistics. The State data are combined into national estimates of employment by Standard Industrial Classification (SIC) industry. This is an ongoing survey that began in 1977. Each year one of three subsectors (manufacturing, trade and regulated industries, or other nonmanufacturing) is surveyed. Using an employment growth model, the separate surveys are extrapolated to provide single annual estimates of industrial employment.

Major Findings:

Science and engineering (S/E) employment in private industry was virtually unchanged between 1970 and 1980, with a decline of S/E employment in manufacturing industries being offset by a gain in nonmanufacturing. Of the 2.1 million persons employed as scientists, engineers, and technicians in 1980, almost one-half were technicians. Of the remaining 1.1 million, about 80% were engineers.

Responsible SRS Organization:

Scientific and Technical Personnel Studies Section/Utilization Studies Group

Institution/Principal Investigator:

[Intramural]

Availability:

Scientists, Engineers, and Technicians in Private Industry, 1978-80, Special Report, NSF 80-320, March 1981; National Technical Information Service, Springfield, Virginia 22161, PB 81-187403, $6.50 (paper copy), $3.50 (microfiche); and Scientists, Engineers, and Technicians in Private Industry, 1980, Detailed Statistical Tables, NSF 81-329, January 1982, National Technical Information Service, Springfield, Virginia 22161, PB 83-100453, $12.00 (paper copy), $4.50 (microfiche); both reports also available from SRS/Editorial and Inquiries Unit.

SECTION II. HUMAN RESOURCES

B. Utilization

2. National

Project:

Characteristics of the U.S. Science and Engineering (S/E) Doctorate Population, 1981

Objective:

To obtain the professional, employment, and educational characteristics of the Nation's S/E doctorate population.

Method:

A sample (50,000) of S/E doctorate holders who received their degrees during the period 1938-80 was drawn from the Doctorate Roster. The resulting individuals received a mail questionnaire during the spring of 1981 and useable responses were received from 31,500 individuals. The data collected focused on demographic, employment, and professional characteristics.

Major Findings:

The report presents the detailed statistical results of the 1981 survey, including demographic, educational, and employment data on Ph. D. scientists and engineers. In addition, the report contains selected data from the surveys conducted in 1975, 1977, and 1979.

Responsible SRS Organization:

Scientific and Technical Personnel Studies Section/Demographic Studies Group

Institution/Principal Investigator:

National Academy of Sciences/Dr. Betty D. Maxfield

Availability:

Characteristics of Doctoral Scientists and Engineers in the United States: 1981, Detailed Statistical Tables; publication is expected by February 1983, and will become available from SRS/Editorial and Inquiries Unit.

Project:

Impact of Defense Buildup on the Scientific and Engineering (S/E) Work Force

Objective:

To assess the adequacy of the supply of scientists and engineers to meet the demands generated by the proposed defense buildup over the 1980-86 period.

Method:

The research entails utilization of the Defense Inter-Industry Forecasting Model (DIF) of Data Resources, Inc., to generate employment requirements by detailed occupation and industrial classifications in both the defense and nondefense sectors. Detailed occupational requirements generated by various combinations of defense expenditure patterns and macroeconomic conditions will be compared to the projected supply of S/E personnel to identify possible shortages. The projected supply will be derived by use of a dynamic simulation model that forecasts degree conferrals, curriculum choice, labor force participation, and occupational mobility.

Major Findings:

NA

Responsible SRS Organization:

Scientific and Technical Personnel Studies Section/Utilization Studies Group

Institution/Principal Investigator:

[Intramural]

Availability:

Expected to become available in the fall of 1982. For further information contact SRS/Editorial and Inquiries unit.

Project:

1982 Postcensal Data on Scientists and Engineers

Objective:

To obtain the professional, employment, and educational characteristics of individuals in selected occupations included in the 1980 Decennial Census.

Method:

From selected occupations a sample of individuals (150,000) was drawn from the 1980 Census of Population and Housing. This sample was stratified in terms of sex and race, and the members of the sample received a mail questionnaire in the spring of 1982. The data collected focused on demographic, employment, and professional characteristics of respondents.

Major Findings:

NA

Responsible SRS Organization:

Scientific and Technical Personnel Studies Section/Demographic Studies Group

Institution/Principal Investigator:

Bureau of the Census/Bruce Chapman

Availability:

Characteristics of the Scientists and Engineers in the 1982 Postcensal Survey has a tentative publishing date of September 1983.

Project:

Women and Minorities in Science and Engineering

Objective:

To present a factual picture of the current situation and recent trends in the participation of women and minority group members in science and engineering (S/E) employment and training. The report, the first in a biennial series, is required under Public Law 96-516.

Method:

Based on NSF survey data and secondary data sources. Report is primarily factual, with some analytical treatment of the data.

Major Findings:

Employment of female scientists and engineers rose about 32% between 1974 and 1978, increasing the female share of the S/E work force from 7.8% to 9.4%. Despite this increase, women were still underrepresented since they constituted over 40% of all professional and related workers in 1978. Employment of scientists and engineers belonging to racial minority groups rose by almost 25% between 1974 and 1978 (to 90,000), increasing their share of the S/E work force to about 4%. Despite this gain, blacks were still underrepresented. Although blacks constituted about 7% of all professional and related workers, they represented about 1.6% of the S/E work force. Asians, who represented about 2% of the S/E work force, were not underrepresented.

Responsible SRS Organization:

Scientific and Technical Personnel Studies Section

Institution/Principal Investigator:

[Intramural]

Availability:

Women and Minorities in Science and Engineering, NSF 82-302, January 1982, Supt. of Documents, U.S. Government Printing Office, Washington, D.C. 20402, Stock Number 038-000-00498-1, $7.00; National Technical Information Service, Springfield, Virginia 22161, PB 82-261066, $13.50 (paper copy), $4.00 (microfiche); also available from SRS/Editorial and Inquiries Unit.

SECTION II. HUMAN RESOURCES

B. Utilization

3. Other

Project:

Computer Model Estimates of the Science and Engineering (S/E) Population

Objective:

To develop a computer model for the production of composite estimates of the demographic and employment characteristics of scientists and engineers in the United States, using the results of several SRS-sponsored surveys of S/E personnel resources.

Method:

The computer model (SETAB) will consist of the three sets of routines. The first set will extract information from the raw files and create smaller microdata files that may be processed economically and rapidly. A second set will be used to manipulate the survey data by "aging" the data collected in one year to represent a population in a later year or to impute missing information. The third set will produce a series of tables consistent in format with previously published NSF data. Data files and methods thus developed will be used to trace changes in the social, demographic, and employment characteristics of scientists and engineers. Among the characteristics to be quantified are changes in sex and ethnic characteristics, labor force status, occupation, sector of employment, and primary work activity.

Major Findings:

SETAB has been developed and used to produce 1980 tabulations of scientists and engineers and comparable 1978 and 1976 estimates based on 1980 input.

Responsible SRS Organization:

Scientific and Technical Personnel Studies Section/Demographic Studies Group

Institution/Principal Investigator:

Mathematica Policy Research, Inc./David Edson

Availability:

[Not applicable]

Project:

Effects of Technology Changes on the Demand for Scientific and Engineering (S/E) Manpower

Objective:

To develop a model that would relate changes in an industry's technology to changes in the occupational structure of that industry for S/E personnel. The semiconductor industry was chosen as an example because of the very rapid advance in the technology used in the manufacture of microelectronic products.

Method:

The study examined historical changes in the technology development of the semiconductor industry for the period 1964-76. Microdata from the Department of Commerce and information obtained through interviews at a number of semiconductor manufacturers were included in the examination. Based on measures of four parameters over time (number of components per chip, minimum average dimensions, silicon die area, and logic gate cost), an artificial index of technology growth was formulated. The index was then examined in relationship to employment patterns in the industry with the latter being the dependent variable (using regression analysis). Finally, a case was made for extrapolation of the index to 1985 as a reasonable measure of future technological growth. Using the regression coefficients for S/E employment developed for the base period, employment growth was projected to 1985.

Major Findings:

During the seventies the technological change index was rapid and even. By extrapolating the rate of change through 1985, they arrived at an index of 204 or 185 points above the 1971 level and 99 points above the 1979 level. S/E employment constituted 9% of total employment in 1964 and rose to 15% by 1971. The number of scientists and engineers in semiconductors increased from 5,000 in 1964 to 11,000 in 1971, and is projected to 22,000 by 1985.

Responsible SRS Organization:

Scientific and Technical Personnel Studies Section/Utilization Studies Group

Institution/Principal Investigator:

Sterling Hobe Corporation/Ivars Gutmanis

Availability:

Report on Changes in the Demand for Scientific and Technical Manpower Induced by Changes in Technology, National Technical Information Service, Springfield, Virginia 22161, PB 82-180548, $16.50 (paper copy), $4.00 (microfiche).

Project:

Methodological Approach to 1979/80 New Entrants Surveys

Objective:

To document the methodology used, to present design characteristics and error estimates of the sample, and to report on the rates of survey response.

Method:

Describes the questionnaire, sample design, data collection, data processing, response, and sampling error of the 1980 Surveys of New Entrants.

Major Findings:

Traces the various steps of the survey development.

Responsible SRS Organization:

Scientific and Technical Personnel Studies Section/Demographic Studies Group

Institution/Principal Investigator:

Westat, Inc./George K. Schueller

Availability:

Methodological Approach to 1979/80 New Entrants Surveys, March 1981, National Technical Information Service, Springfield, Virginia 22161, PB 82-115403, $12.00 (paper copy), $4.00 (microfiche).

SECTION II. HUMAN RESOURCES

C. Special Studies

Project:

Comparative Trends in Academic Abilities of Doctorates in Science, Engineering, and Other Professions

Objective:

To determine if persons of high academic ability and potentially high productivity are choosing careers in professions at the expense of the sciences or engineering.

Method:

Scholastic Aptitude Test and American College Testing scores of persons who received science and engineering doctorates during the past 15 years will be compared to those for persons receiving Ph. D.'s in the humanities, or degrees in business, law, and medicine. The 15-year time frame of the study will allow for the analysis of data reflecting a variety of labor market conditions for new doctorates.

Major Findings:

NA

Responsible SRS Organization:

Scientific and Technical Personnel Studies Section/Utilization Studies Group

Institution/Principal Investigator:

Educational Testing Service/Rodney T. Hartnett

Availability:

Expected to become available in the fall of 1982. For further information, contact the SRS/Editorial and Inquiries Unit.

Project:

The New Entrants Component of Scientific and Technical Labor Supply

Objective:

To examine student choices of undergraduate major and graduates' choice of occupation as they relate to labor market conditions.

Method:

Student choices of field of study and field of employment as they related to labor market conditions were analyzed econometrically, using data from the NSF New Entrants Surveys.

Major Findings:

The results support the proposition that market forces are an important influence on the supply of new entrants to science and engineering occupations. Although the results indicate that nonmarket influences may also have decisive impacts on these processes, models that describe the supply processes in terms of market determination may be useful to account for and possibly to predict general trends.

Responsible SRS Organization:

Scientific and Technical Personnel Studies Section/Utilization Studies Group

Institution/Principal Investigator:

Oklahoma State University/Jack Fiorito

Availability:

Curriculum Choice and Occupational Attainment in Science and Engineering, National Technical Information Service, Springfield, Virginia 22161, PB 82-179441, $12.00 (paper copy), $4.00 (microfiche).

Project:

Postschool Investment in Training and Work Experience and Its Impact on Earnings

Objective:

To determine whether postschool education and work experience of bachelor's- and master's-degree scientists and engineers differ by sex, particularly with respect to earnings.

Method:

Data from surveys of experienced scientists and engineers and new entrants were analyzed, using the econometric methods to measure differences in earning and in other job-related factors attributable to gender.

Major Findings:

Training and work experience are significantly related to scientists' earnings and are important determinants in the earnings gap between experienced men and women scientists. The contribution to the sex differential in earnings comes not from a difference in the training and experience received by men and women, but rather from the fact that women have fewer years of professinal experience and spend less of their career time in management activities. Early career work activities other than management were found to affect earnings at mid-career. The sex differences in the work activities of recent graduates, however, are different from those of the experienced group. The effect of such differences would be to increase women's earnings in the future, but not enough to offset the differential for professional years of experience that favors males, if past trends in this factor continue.

The unemployment rates for recent graduates in science and engineering who were surveyed in 1978 and 1979 were 4.3% for females and 2.2% for males. When controlling for mobility and full-time availability factors, however, the unemployment rate falls to 1.1% for males and 1.2% for females, virtually eliminating the sex differential.

Responsible SRS Organization:

Scientific and Technical Personnel Studies Section/Utilization Studies Group

Institution/Principal Investigator:

Oak Ridge Associated Universities (Department of Energy)/Michael G. Finn

Availability:

Training, Work Experience, and the Earnings of Men and Women Scientists, ORAU-193, National Technical Information Service, Springfield, Virginia 22161, DE 82-2007564, $7.50 (paper copy), $4.00 (microfiche).

Project:

U.S./U.S.S.R. Information Exchange Program on the Training and Utilization of Scientists, Engineers, and Technicians

Objective:

To enable representatives of the United States and the Soviet Union to exchange information on the training and utilization of scientific, engineering, and technical personnel in accordance with the Agreement for Cooperation in the Fields of Science and Technology established in 1972.

Method:

Representatives of both countries constituted the Joint Subgroup on Training and Utilization prepared detailed reports describing the policies and practices in their country that concern the training and utilization of scientists and engineers. After the U.S. representatives had studied the report developed by their Soviet counterparts, and vice versa, the representatives of both countries prepared correspondence in which they exchanged questions and responses regarding the content of the respective survey reports. After these documents were exchanged, a final conference was held in Washington, D.C., in 1978 to clarify remaining questions. Separate from this program, but based on information developed from these reports and from other sources, a comparative analysis of the two systems was prepared by SRI International in January 1981.

Major Findings:

The basic Soviet report covers the following topics: Structure of the educational system; role of higher education in training specialists; content and organization of the educational process in higher educational institutions; increasing the qualifications of specialists in institutions of higher education; scientific research in institutions of higher education; specialized secondary education; planning and development of higher and specialized secondary education; total number of scientists, engineers, technical personnel, and auxiliary workers; structure of scientific personnel; distribution of scientific personnel by types of organizations; mobility of scientific personnel; and statistical appendixes.

The basic U.S. report covers the following topics: Primary and secondary education; historical explanations of diversity and decentralization of U.S. higher education; structure of the higher educational system; undergraduate admission requirements and financial aid; college curricula and college students; college graduates at the bachelor's level; graduate students and advanced degrees; postdoctorals; training of

technicians; employment of scientists, engineers, and technicians; salaries of scientists, engineers, and technicians; mobility of scientists and engineers; supplementary training of scientists and engineers; projecting future supply and demand for scientists, engineers, and technicians; and statistical appendix.

Responsible SRS Organization:

Scientific and Technical Personnel Studies Section/Utilization Studies Group

Availability:

For additional information on the availability of these materials, consult the SRS sponsor.

1. U.S.S.R. Survey Reports (in Russian)

a. Zhiltsov, E., V. Krutov, A. Ryabinin, "The Training and Utilization of Scientific and Engineering-Technical Personnel in the USSR: Part I," Revised Final Report, Moscow: Faculty of Economics, Economics of Education Laboratory (November 1977).

b. Mikulinskiy, S. R., S. A. Kugel', V. I. Maslennnikov, E. I. Mirskii, P. B. Schelisch, "The Training and Utilization of Scientific and Engineering-Technical Personnel in the USSR: Part II," Moscow (December 1976).

c. Kugel', S. A. and V. S. Maslennikov, "The Mobility of Scientific Personnel: Supplement to the 'Survey Report on Scientific Personnel in the USSR,'" Working Material, Moscow (July 1977).

2. U.S. Survey Reports

a. Ailes, Catherine P., Francis W. Dresch, Hazel T. Ellis, Anne R. Lieberman, and Harry V. Kincaid, "Training and Utilization of Scientific and Engineering Technical Personnel: Chapters 1-9," SRI International, SSC-TN-4226-2 (February 1977).

b. Dresch, Francis W., Hazel T. Ellis, and Joel L. Barries, "Training and Utilization of Scientific and Engineering Technical Personnel: Chapters 10-14," SRI International, SSC-TN-4226-2 (March 1977).

c. "Training and Utilization of Scientific and Engineering Technical Personnel: Appendices," SRI International, SSC-TN-4226-3 (November 1976). [Note: The foregoing U.S. Survey Reports also are available at National Technical Information Service, Springfield, Virginia 22161, PB 82-203811, $26.50 (paper copy), $4.00 (microfiche).]

3. SRI International Comparison Study

Comparative Analysis: Training and Utilization of Scientists and Engineers, U.S./U.S.S.R., Catherine P. Ailes, Francis Rushing, SRI International (January 1981).

4. Conference Reports

a. Ailes, Catherine P., "Report on the Conference of the U.S.-U.S.S.R. Joint Subgroup on the Training and Utilization of Scientific, Engineering and Technical Personnel: March 8, 9, and 10, 1978," SRI International (May 1978).

b. Rushing, Francis W., "Report on the Moscow Conference of the U.S.-U.S.S.R. Joint Subgroup on the Training and Utilization of Scientific, Engineering and Technical Personnel: June 26, 27, and 28, 1978," SRI International (August 1978).

Summaries of Materials Prepared by the Soviet Side, and Translations:

a. Ailes, Catherine P., Hazel T. Ellis, and Francis W. Rushing, "Summary of Soviet Report on the Training and Utilization of Scientific, Engineering and Technical Personnel in the USSR," Final Report (incorporating summary report of July 1977 on Part I and Part II of Soviet Report and summary report of December 1977 on Mobility Supplement to Soviet Report)(1979). [Note: Available also at National Technical Information Service, Springfield, Virginia 22161, PB 82-203803, $15.00 (paper copy), $4.00 (microfiche).]

b. "Tables from the Soviet Report on the Training and Utilization of Scientific, Engineering, and Technical Personnel in the USSR," (Translation), SRI International (February 1978).

c. "Description and Unedited Translation of New Material Contained in the Revised Training Portion of the Soviet Report on 'The Training and Utilization of Scientific, Engineering and Technical Personnel in the USSR,'" SRI International (January 1978).

d. "Translation of Soviet Response to Questions Posed by the U.S. Regarding the Training Portion of the Report on the 'The Training and Utilization of Scientific, Engineering and Technical Personnel in the USSR,'" SRI International (February 1978).

e. "Translation of Soviet Response to Questions Posed by the U.S. Regarding the Utilization Portion of the Report on 'The Training and Utilization of Scientific, Engineering and Technical Personnel in the USSR,'" SRI International (February 1978).

f. "Translation of Soviet Response to Questions Posed by the U.S. Regarding the Soviet Report on the Mobility of Scientific Personnel," SRI International (July 1979.)

SECTION III. FUNDING OF SCIENCE AND TECHNOLOGY

A. Government

Project:

Federal R&D Funding, FY 1981-83

Objective:

To develop comprehensive data and analyses on funding levels for R&D and R&D plant programs of Federal agencies in the 1983 budget. To present data and analyses based on a survey of all agencies sponsoring R&D programs, covering such categories as basic research, applied research, development, performing sectors, fields of science, and geographic (State) distribution.

Method:

The survey is a recurring one, using a questionnaire that is sent annually to all Federal agencies that support R&D programs. Agency subdivisions that respond to the survey are, for the most part, budget offices where records are maintained of past and ongoing program levels and latest budget request levels. Responses to the 1981-83 (volume XXXI) survey were received and reviewed by NSF by mid-July 1982. They were processed by computer in the form of 132 detailed statistical tables.

Major Findings:

In fiscal year 1983 total Federal R&D obligations (excluding R&D plant) are an estimated $43.0 billion, or 10% higher than the 1982 level. Most of this increase is the result of a sharp rise in anticipated development funding by the Department of Defense (DOD). Federal R&D obligations to industrial firms, including federally funded research and development centers (FFRDC's), are expected to rise 15% in 1983, well ahead of any other R&D-performing sector. The increase is largely derived from DOD programs. R&D obligations to universities and colleges show an increase of 3% in 1983. The Department of Health and Human Services is still the leading support agency, but in 1983 DOD is expected to move to second place in support to this sector, ahead of the National Science Foundation. An increase of 13% is anticipated in Federal development funding in 1983; an increase of 3% in applied research funding; and an increase of 9% in support to basic research, chiefly resulting from increases in the space, defense, and energy areas.

Responsible SRS Organization:

R&D Economic Studies Section/Government Studies Group

Institution/Prinipal Investigator:

[Intramural]

Availability:

Federal Funds for Research and Development, Fiscal Years 1981, 1982, and 1983, Volume XXXI, Detailed Statistical Tables, NSF 82-326, will be issued in early fall 1982 and will be available from the National Technical Information Service, Springfield, Virginia 22161, and SRS/Editorial and Inquiries Unit. Federal Funds for Research and Development, Historical Tables: Fiscal Years 1967-1983 is unpublished and will be available gratis by November from NCESS/Government Studies Group, upon request. A final report based on the volume XXXI survey will be published early in 1983.

Project:

Federal R&D Programs by Budget Function, FY 1981-83

Objective:

To provide a complete overview of Federal R&D program planning and to offer a record of amounts requested in the 1983 budget. Also to afford a view of R&D amounts as shares of total budget function amounts, and to provide a means of quickly assessing relative priorities given to various R&D functional areas and various R&D programs within the Federal R&D total. To provide a basis for keeping track of subsequent congressional appropriation actions subsequent to the budget presentation. The report groups approximately 600 R&D programs included in the 1983 Federal budget by budget function. Tables are accompanied by brief descriptions of funding changes for specific programs.

Method:

Sources of funding data were reports provided by the agencies to the Office of Management and Budget for Special Analysis K: Research and Development in the 1983 budget, presented in February 1982, plus agency budget justification documents prepared for the Congress, and some information provided informally by some of the smaller R&D support agencies. The data were developed and arranged by budget function by NSF/SRS staff, and descriptions of budget changes were produced from budget documents.

Major Findings:

Total R&D budget authority in the 1983 budget was $43,174 million, 12% more than the 1982 total of $38,701 million. Nearly all R&D growth was focused in the national defense area, which showed projected growth of $4,412 million, or 20%, 1983 over 1982. An increase of $657 million, or 12%, was shown for space research and technology with an emphasis on space shuttle flight operations and space science. A net decrease of $594 million, or 5%, for nondefense/nonspace R&D programs in 1983 followed a decrease of $925 million, or 8%, in 1982. An increase of 9% for total Federal basic research in 1983, to $5.9 billion compared with an increase of 8% in 1983 for the Federal total excluding defense basic research. The share of national defense within the Federal R&D total was an estimated 61% in the 1983 budget, compared with 57% in 1982.

Responsible SRS Organization:

R&D Economic Studies Section/Government Studies Group

Institution/Principal Investigator:

[Intramural]

Availability:

Federal R&D Funding by Budget Function: Fiscal Years 1980-83, April 1982, available from SRS/Editorial and Inquiries Unit.

Project:

Federal Support to Universities, Colleges, and Selected Nonprofit Institutions, FY 1980

Objective:

To develop annual data from the Federal agencies believed to fund the largest programs in support of academic science/engineering (S/E) activities, particularly research and development.

Method:

Fifteen agencies received instruction booklets and institutional Code Books defining the obligations and disciplines concerned for FY 1980. There were four data elements: Agency, academic institution, discipline, and type of activity (R&D, R&D plant, facilities/equipment, fellowships/traineeships/training grants, general S/E support, and other S/E and nonscience activities). The survey was closed out July 1981.

Major Findings:

Obligations from Federal agencies to universities and colleges between FY 1979 and FY 1980 increased by 1% in constant 1972 (deflated) dollars, a lower rate of increase than during the previous 4-year period (6% in real terms). Universities granting S/E doctoral or equivalent degrees (including health professional) received more than three-fourths of all Federal academic support. In real-dollar terms, the overall R&D obligations total declined by 1/2% during the year.

Responsible SRS Organization:

R&D Economic Studies Section/Universities and Nonprofit Institutions Studies Group

Institution/Principal Investigator:

[Intramural]

Availability:

"1980 Federal Obligations to Universities and Colleges Rose Slightly in Constant Dollars," Highlights, NSF 82-301, March 29, 1982, available from SRS/Editorial and Inquiries Unit; and Federal Support to Universities, Colleges, and Selected Nonprofit Institutions, Fiscal Year 1980, Final Report, NSF 82-308, July 1982, Supt. of Documents, U.S. Government Printing Office, Washington, D.C. 20402, Stock Number 038-000-00508-1, $6.50; National Technical Information Service, Springfield, Virginia 22161, PB 82-257411, $16.50 (paper copy), $4.00 (microfiche); also available from SRS/Editorial and Inquiries Unit. Access to the public-use tapes and documentation for their use are described in the Data User Guide, May 1982, available from the RDESS/Universities and Nonprofit Institutions Studies Group.

Project:

Federal Support to Universities, Colleges, and Selected Nonprofit Institutions, FY 1981

Objective:

To develop annual data from the Federal agencies believed to fund the largest programs in support of academic science/engineering (S/E) activities, particularly research and development.

Method:

Fifteen agencies received instruction booklets and institutional Code Books defining the obligations and disciplines concerned for FY 1981. There were four data elements: Agency; academic institution; discipline; and activity (R&D, R&D plant, instructional facilities/equipment, fellowships/traineeships/training grants, general S/E support, and other S/E and nonscience activities). The survey was closed out in August 1982.

Major Findings:

NA

Responsible SRS Organization:

R&D Economic Studies Section/Universities and Nonprofit Institutions Studies Group

Institution/Principal Investigator:

[Intramural]

Availability:

The Final Report for FY 1981 will include Detailed Statistical Tables and it is anticipated that it will be published by fall 1983. It will become available from SRS/Editorial and Inquiries Unit.

Project:

Indirect Mechanisms of Federal Support for Research and Development

Objective:

To provide background studies of areas selected because of their importance to the planning of Science Indicators--1980, the 13th Annual Report of the National Science Board.

Method:

Selected scholars were commissioned to provide information dealing with indirect mechanisms of Federal support for research and development. These commissioned papers are intended to produce new indicators in this subject area, introduce new interpretations of the data, and to suggest areas of future research.

Major Findings:

Research and development in the United States is supported primarily through direct contributions by Federal, industrial, and other sources. There are several indirect mechanisms, however, that provide fiscal as well as other support and which are discussed in volume II of these papers: Independent Research and Development (IR&D); various ways that industrial organizations provide R&D support; tax policy and its impact on research and development; and several indirect support processes as they operate in the academic sector. In some papers, attempts are made to quantify the contributions made by the indirect support mechanisms discussed.

Responsible SRS Organization:

Science Indicators Unit

Institutions/Principal Investigators:

Massachusetts Institute of Technology/George R. Heaton, Jr.
Cornell University/Franklin A. Long
(Consultant)/Nat C. Robertson
American Association for the Advancement of Science/Willis H. Shapley

Availability:

Papers Commissioned as Background for Science Indicators--1980, Volume II: Indirect Mechanisms of Federal Support of Research and Develoment, National Science Foundation, will be available from the National Technical Information Service, Springfield, Virginia 22161 and is available from the SRS/Science Indicators Unit.

Project:

U.S.-U.S.S.R. Information Exchange Program on Financing Research and Development

Objective:

To enable representatives of the United States and the Soviet Union to exchange information on their systems of financing research and development, in accordance with the Agreement for Cooperation in the Fields of Science and Technology established in 1972.

Method:

Representatives of both countries constitutes the Joint Subgroup on Financing Research and Development, which prepared detailed reports describing the system of financing research and development in their own country. After the U.S. representatives had studied the report developed by their Soviet counterparts, and vice versa, the representatives of both countries prepared correspondence in which they exchanged questions and responses regarding the content of the respective survey reports. After these documents were exchanged, a final confeence was held in Washington, D.C., in 1978, to clarify remaining questions. Separate from this program, but based on information developed from these reports and from other sources, a comparative analysis of the two systems was prepared by SRI International in January 1981.

Major Findings:

The **Soviet Report** analyzes the characteristics of the system of financing "science" (research and development) in the U.S.S.R. It discusses the general principles of Soviet scientific policy, the mechanism of the planning and financing of science on various levels of administration, and the ways and forms of allocating expenditures. It also deals with the structure and function of the State and of other organs that carry out the administration of science, and describes some features of the system of planning scientific and technical activity.

The **U.S. Report** provides a survey of the U.S. system of financing research and development. It includes a discussion of the concept of research and development in the United States and its boundaries with respect to other activities; the classes of organization performing research and development; the planning of R&D funding allocations; the review and expenditure control procedures used in dealing with R&D performers; the major cost components of research and development; R&D financing mechanisms; and the issues in assessing the effectiveness of research and development.

The **Comparative Analysis Report** presents a basic survey comparison of the systems of financing research and development in the United States and the Soviet Union. It compares the concept of research and development in the United States and of "science" in the Soviet Union and describes the boundaries of the two with respect to other activities. The R&D-performing organizations and the principal sources of funding are compared. The report points up the differences between the two systems in the use of institutions and the emphasis on strategic planning. It describes the similarities and significant differences in the allocation of R&D funds and treatment of R&D costs.

Responsible SRS Organization:

R&D Economic Studies Section

Availability:

The publications listed below are available from the National Technical Information Service, Springfield, Virginia 22161. A limited number of copies may also be available from SRS/R&D Economic Studies Section and from SRI International.

1. Valuyev, Ye. I. et al, "Osobennosti Finansirovaniya Nauk v SSR, Moscow (December 1976)(Soviet report). PB 81-249799, $12.00 (paper copy), $4.00 (microfiche).

2. Valuyev, Ye. I. et al, "Unique Characteristics of Financing of Science in the U.S.S.R.," Moscow (translation of the above Soviet report by U.S. Joint Publications Research Service). PB 81-212243, $9.00 (paper copy), $4.00 (microfiche).

3. "Summary of the Soviet Report of the Unique Characteristics of Financing of Science in the U.S.S.R." (Summary prepared February 1978 by SRI International). PB 81-249807, $7.50 (paper copy), $4.00 (microfiche).

4. Dresch, Francis W. and Robert W. Campbell (consultant), "The System of Financing Research and Development in the United States," Washington, D.C. , 1977 (U.S. report prepared by SRI International, SSC-TN-4226-1). PB 81-249815, $13.50 (paper copy), $4.00 (microfiche).

5. "Edited Translation of Answers to the Questions of the American Experts of the Draft of the Soviet Report The Financing of Science in the USSR," (prepared March 1979 by SRI International). PB 81-249823, $6.00 (paper copy), $4.00 (microfiche).

6. "Responses to Questions Posed by the Union of Soviet Socialist Republics on the Report on The System of Financing Research and Development in the United States," (prepared November 1977 by SRI International). PB 81-249831, $7.50 (paper copy), $4.00 (microfiche).

7. "Report on the Conference of the U.S.-U.S.S.R. Joint Subgroup on Financing Research and Development, 8, 9, and 10 March 1978," (prepared March 1979 by SRI International). PB 81-249849, $7.50 (paper copy), $4.00 (microfiche).

8. Ailes, Catherine P., James G. Styles, and Francis W. Rushing, "Financing Research and Development: U.S. and U.S.S.R.," Washington, D.C., January 1981 (prepaed by SRI International, SSC-TN-4226-5).

SECTION III. FUNDING OF SCIENCE AND TECHNOLOGY

B. Industry

Project:

Comparing Industrial R&D Expenditures with Selected Corporate Financial Indicators

Objective:

To determine if there are published corporate financial indicators that can be used (either alone or in conjunction with the traditional R&D/net sales ratios published by NSF) to provide a better assessment of the capability and willingness of U.S. industry to invest in research and development, than is currently possible by using R&D/net sales ratios alone.

Method:

Data that are publicly available from the company annual reports and from Securities and Exchange Commission 10K forms of the largest R&D firms in selected industries will be examined, and an individual firm's R&D expenditures for a 10-year period will be correlated to that firm's net sales, cash flow, and capital expenditures. Implications for the selected industries as a whole may be drawn on the basis of data from the firms included in the study.

Major Findings:

NA

Responsible SRS Organization:

R&D Economic Studies Section

Institution/Principal Investigator:

[Intramural]

Availability:

A final report will be available from SRS/Editorial and Inquiries Unit in 1983.

Project:

Estimates of Company-funded Industrial R&D Expenditures for 1982 and 1983

Objective:

To provide estimates of companies' own financing of research and development in major industries for 1982-83 and to outline the factors that are or will be affecting the funding of these activities.

Method:

The report is based on information obtained from (1) mail responses to an inquiry sent to the members of the NSF Industrial Panel on Science and Technology, and (2) interviews with R&D officials representing firms in the major R&D-performing industries. Of the 90 company representatives contacted during April-June 1982, replies were received from 75. The respondents were asked to estimate the growth, if any, in company-funded R&D expenditures over the previous year for 1982 and 1983, and to provide the factors they believed to be responsible for any changes.

Major Findings:

Total company-funded expenditures for research and development in the United States are estimated to be $37 billion in 1982, an increase of about 10% over 1981. As of mid-1982, most company R&D officials are anticipating a somewhat lower rate of growth in research and development for 1983, resulting in an estimated overall increase of 8% in company-funded R&D activities over 1982. Limiting factors behind these overall R&D expenditure growth rates are economic uncertainty, lower profits, and high interest rates. Most of the respondents commented that current economic conditions made it extremely difficult to project company R&D spending for 1983 and that the 1983 estimates are subject to considerable variation. Of the major R&D-performing industries, the chemicals industry is expected to exhibit the highest percentage increases during 1981-83, 17% in 1982 and 14% in 1983. Many companies in the chemicals industry have been increasing expenditures on R&D projects aimed at exploring recent breakthroughs in biology and biochemistry, especially those involving genetic engineering.

Responsible SRS Organization:

R&D Economic Studies Section/Industry Studies Group

Institution/Principal Investigator:

[Intramural]

Availability:

"Companies Plan R&D Expenditure Increases for 1983: Growth Rate Down," Highlights, NSF 82-324, September 9, 1982, available from SRS/Editorial and Inquiries Unit.

Project:

Feasibility of Developing Integrated Sets of Industrial R&D Economic Data

Objective:

To develop an internally consistent data bank for exploring relationships between industrial R&D expenditures and the economy.

Method:

Specifications for a user-oriented data set will be developed, and an inventory of alternative R&D data bases will be taken. Each data base will be evaluated in terms of its validity, reliability, compatibility with other data sources, and usefulness. Alternative strategies for augmenting the NSF/Census industrial R&D data base will be developed through the use of other data bases or through minor modifications of existing data collection procedures. During the course of the study, information regarding specific details of these data bases will be obtained from government agencies, trade associations, and corporations. The feasibility study can provide a basis for the development of an integrated set of industrial R&D and economic data bases.

Major Findings:

NA

Responsible SRS Organization:

R&D Economic Studies Section/Industry Studies Group

Institution/Principal Investigator:

TARP, Inc.

Availability:

An Examination of Possible Linkages Between the National Science Foundation's Industrial R&D Data Set and Other Economic Data Bases. Final Report; will be available from the National Technical Information Service, Springfield, Virginia 22161.

Project:

Research and Development in Industry, 1979

Objective:

To provide data on the resources allocated to research and development by domestic firms. These statistics are published annually and present historical trend information in addition to current survey year data.

Method:

The annual survey of industrial research and development is conducted by the Bureau of the Census for NSF. Companies surveyed are included in a sample that consists of 15,000 companies. All manufacturing and selected nonmanufacturing companies with 1,000 or more employees are surveyed every year; those with fewer than 1,000 employees are surveyed at rates depending upon the industry concerned and the amount spent on research and development. In the absence of respondent-distributed data, the Census Bureau estimates data in accordance with past performances and industry averages.

Major Findings:

R&D performance by industry reached $38 billion in 1979, 14% above the previous year's level. Company-funded research and development increased 15% whereas that portion of industrial research and development supported by the Federal Government rose 11% over the earlier year. Outlays for energy-related R&D projects totaled $3.7 billion or 21% higher than during 1978 and now comprise nearly 10% of the total industrial R&D effort. The automotive industry registered the largest percentage increase, 16%, of the leading R&D-performing industries. Firms employed a record number of R&D scientists and engineers in January 1980, representing a gain of 5% over the previous January.

Responsible SRS Organization:

R&D Economic Studies Section/Industry Studies Group

Institution/Principal Investigator:

[Intramural]

Availability:

"Real Growth in Industrial R&D Peformance Continues into 1979," Highlights, NSF 81-313, June 29, 1981, available from SRS/Editorial and Inquiries Unit; Research and Development in Industry, 1979, Detailed Statistical Tables, NSF 81-324, National Technical Information Service, Springfield, Virginia 22161, PB 82-257361, $9.00 (paper copy), $4.00 (microfiche); and Research and Development in Industry, 1979, Final Report, NSF 82-304, June 1982, National Technical Information Service, Springfield, Virginia 22161, PB 82-257346, $9.00 (paper copy), $4.00 (microfiche); both reports also available from SRS/Editorial and Inquiries Unit.

Project:

Research and Development in Industry, 1980

Objective:

To provide data on the resources allocated to research and development by domestic firms. These statistics are published annually and present historical trend information in addition to current survey year data.

Method:

The annual survey of industrial research and development is conducted by the Bureau of the Census for NSF. Companies surveyed are included in a sample that consists of 15,000 companies. All manufacturing and selected nonmanufacturing companies with 1,000 or more employees are surveyed every year; those with fewer than 1,000 employees are surveyed at rates depending upon the industry concerned and the amount spent on research and development. In the absence of respondent-distributed data, the Census Bureau estimates data in accordance with past performances and industry averages.

Major Findings:

Total expenditures by industry for performing research and development reached $44 billion in 1980, 15% above the previous year's level. Companies' own funding increased 17%, whereas that portion of industrial R&D support by the Federal Government rose 12% over the earlier year. Expenditures on energy-related R&D activities grew 15% to over $4.4 billion in 1980. This was the first year since 1972, when energy R&D data were first collected, that these outlays did not rise at a significantly faster rate than total industrial R&D expenditures. Of the five major R&D-performing industries, the machinery industry registered the largest percentage increase overall between 1979 and 1980--18%. The smallest gain was reported by companies in the automative industry--less than 10%. Firms employed an all-time high number of R&D scientists and engineers in January 1981--470,000, an increase of over 5% above the previous year's level.

Responsible SRS Organization:

R&D Economic Studies Section/Industry Studies Group

Institution/Principal Investigator:

[Intramural]

Availability:

"Industrial R&D Expenditures in 1980 Show Real Growth for Fifth Consecutive Year," Highlights, NSF 81-331, December 31, 1981, available from SRS/Editorial and Inquiries Unit; Research and Development in Industry, 1980, Detailed Statistical Tables, NSF 82-317, August 1982, National Technical Information Service, Springfield, Virginia 22161, PB 82-257361, $9.00 (paper copy), $4.00 (microfiche); also available from SRS/Editorial and Inquiries Unit.

Project:

Trends in Industrial Basic Research Expenditures

Objective:

To examine trends and provide estimates of spending by companies of their own funds on basic research and to outline the factors that have affected or will be affecting the funding of basic research projects in 1981 and 1982.

Method:

The report will be based on information obtained from (1) mail responses to an inquiry sent to the members of the NSF Industrial Panel on Science and Technology, and (2) interviews with other R&D officials representing firms in the major R&D-performing industries. The respondents were asked to estimate the growth, if any, in company-funded basic research expenditures over the previous year for 1981 and 1982 and to describe factors they believed to be responsible for any changes.

Major Findings:

NA

Responsible SRS Organization:

R&D Economic Studies Section/Industry Studies Group

Institution/Principal Investigator:

[Intramural]

Availability:

Expected completion date: fall 1982.

Project:

Venture Capital Investment in Small High-Technology Companies

Objective:

To estimate the venture capital industry's total annual funding of small companies, to estimate the funding of high-technology companies, and to distribute the funding by field of technology.

Method:

Use of a data base collected by the Venture Economics Company covering new financing by venture capital companies.

Major Findings:

Venture funding increased markedly from the low in 1975 to 1980. The high-technology share has scarcely changed. Computer-related financings are the most frequent, but energy-related funding increased notably from 1975 to 1980.

Responsible SRS Organization:

Science Indicators Unit

Institution/Principal Investigator:

Venture Economics/Norman D. Fast

Availability:

Venture Capital Investments and Small, High-Technology Companies: A Measure of the High-Technology Small Business Sector, will be available from the National Technical Information Service, Springfield, Virginia 22161.

SECTION III. FUNDING OF SCIENCE AND TECHNOLOGY

C. Universities, Colleges, and Other Nonprofit Organizations

Project:

R&D Funds in Academic Science and Engineering, FY 1980

Objective:

To collect annual data from academic institutions spending over $50,000 for separately budgeted research and development.

Method:

FY 1980 data were tabulated and analyzed based on responses to questionnaires from 90% of the 560 institutions and their affiliated federally financed R&D centers. There were several data elements: Source of support; amount allocated to basic research; by discipline of both total and federally financed R&D expenditures; research equipment expenditures from separately budgeted R&D funds by discipline; and capital expenditures for scientific and engineering (S/E) activities. The survey was closed out in July 1981.

Major Findings:

Academic separately budgeted R&D expenditures in FY 1980 in constant 1972 (deflated) dollars increased 4% over FY 1979. Federally funded R&D support showed a 5% constant-dollar increase during the same time. Industry funding of academic research and development was up by 13% in constant dollars. Academic basic research expenditures increased by 3% in constant dollars, accounting for two-thirds of all academic R&D activities. Expenditures for S/E research equipment accounted for about 6% of total academic R&D spending.

Responsible SRS Organization:

R&D Economic Studies Section/Universities and Nonprofit Institutions Studies Group

Institution/Principal Investigator:

[Intramural]

Availability:

"Academic R&D Expenditures Increased 4% in Real Terms Between FY 1979 and FY 1980, But Leveled in FY 1981," Highlights, NSF 82-309, June 25, 1982, available from SRS/Editorial and Inquiries Unit; Academic Science: R&D Funds, Fiscal Year 1980, Detailed Statistical Tables, NSF 82-300, April 1982, National Technical Information Service, Springfield, Virginia 22161, PB 82-263724, $12.00 (paper copy), $4.00 (microfiche); also available from SRS/Editorial and Inquiries Unit. Access to the public-use tapes and documentation for their use are described in the Data User Guide, May 1982, available from the RDESS/Universities and Nonprofit Institutions Studies Group.

Project:

R&D Funds in Academic Science and Engineering, FY 1981

Objective:

To collect data from academic institutions spending over $50,000 for separately budgeted research and development.

Method:

FY 1981 data were tabulated and analyzed based on responses to questionnaires from 90% of the 560 institutions and their affiliated federally financed R&D centers. There were several data elements: Source of support; amount allocated to basic research; discipline of both total and federally financed R&D expenditures; research equipment expenditures from separately budgeted R&D funds by discipline; and capital expenditures for scientific and engineering activities. The survey was closed out in August 1982.

Major Findings:

NA

Responsible SRS Organization:

R&D Economic Studies Section/Universities and Nonprofit Institutions Studies Group

Institution/Principal Investigator:

[Intramural]

Availability:

It is anticipated that Detailed Statistical Tables will be published by fall 1983, and will become available from SRS/Editorial and Inquiries Unit.

SECTION III. FUNDING OF SCIENCE AND TECHNOLOGY

D. Projections

Project:

R&D Funding Projections, 1990

Objective:

To present an assessment of future U.S. R&D spending levels by relating R&D expenditures and other economic variables.

Method:

Projections were developed from relationships between R&D expenditures, industry employment, and Federal purchases of goods and services. Historical R&D trend data were used to project R&D spending in the university and nonprofit sectors.

Major Findings:

National R&D expenditures, as measured in terms of 1972 dollars, are projected to reach between $43.5 billion and $46.7 billion in 1990. This range, based on average annual increases of between 2.5% and 3.0% over 1979, compares with an average annual increase of 4.5% between 1975 and 1979.

Responsible SRS Organization:

R&D Economic Studies Section

Institution/Principal Investigator:

[Intramural]

Availability:

1990 R&D Funding Projections, Special Report, NSF 82-315, July 1982; will be available from the Supt. of Documents, U.S. Government Printing Office, Washington, D.C. 20402, and from the National Technical Information Service, Springfield, Virginia 22161; also available from SRS/Editorial and Inquiries Unit.

SECTION III. FUNDING OF SCIENCE AND TECHNOLOGY

E. Other

Project:

Construction of Price Indexes for R&D Inputs

Objective:

To develop a set of price indexes for industrial R&D expenditures for use in economic analysis and policy research.

Method:

The study will build on previous work in the area for the years 1969 and 1979 to obtain price indexes for a sample of firms in eight industries for 1980, 1981, and 1982. Indexes in four other industries will also be developed. An evaluation of various R&D price indexes based on proxies will also be undertaken as well as an investigation of the factors responsible for differences among R&D inputs in their rate of price increase.

Major Findings:

NA

Responsible SRS Organization:

R&D Economic Studies Section

Institution/Principal Investigator:

University of Pennsylvania/Prof. Edwin Mansfield

Availability:

Expected date of publication: July 1985.

Project:

The Influence of Outside Research Support on the Financial Soundness of Academic Institutions

Objective:

To determine whether the 100 leading research universities are becoming increasingly dependent on outside (particularly Federal) funding, to examine the extent to which Federal research spending is concentrated within these institutions, and to demonstrate the Federal dependency on these institutions for research needs.

Method:

Data collected from the leading 100 research performers by NSF and the National Center for Education Statistics for the period 1975-79 were used as the basis for the analysis. Because of differences in the number of reporting units in the two sources of data, 71 institutions formed the core group to be studied. To ensure accuracy and comparability of these data, members of an evaluation panel verified the data collected. Both descriptive and multivariate anlayses of funding were performed, and comparisons were made with characteristics of the higher education universe of 3,000 institutions.

Major Findings:

These institutions received major shares of their funds from Federal sources, but contrary to the original hypothesis, they were not increasingly dependent on such funds. Since constant-dollar increases in Federal grants and contracts have been outpaced by constant-dollar gains in other revenue sources, relative dependency on Federal funding lessened to some degree during the time period. Success in Federal funding, it was found, was often accompanied by success in obtaining funds from other sources.

Responsible SRS Organization:

R&D Economic Studies Section/Universities and Nonprofit Institutions Studies Group

Institution/Principal Investigator:

National Center for Higher Education Management Systems/Ms. Marilyn McCoy

Availability:

Financing at the Leading 100 Research Universities, Final Report, SRS 7911096, May 1981, available from the National Center for Higher Education Management Systems, P.O. Drawer P, Boulder, Colorado 80302; also available from the National Technical Information Service, Springfield, Virginia 22161, PB 82-242587, $24.00 (paper copy), $4.00 (microfiche), PB 82-242579, $15.00 (paper copy), $4.00 (microfiche), and Executive Summary, PB 82-114992,, $7.50 (paper copy), $4.00 (microfiche).

Project:

Strategies for Developing Estimates of Academic Basic Research Expenditures by Field of Science and Engineering

Objective:

To design and test alternative strategies for developing reliable estimates of academic basic research expenditures, by science/engineering (S/E) field, and to gain institutional cooperation in the process.

Method:

The contractor researched and evaluated alternative approaches for gathering data with sufficient reliability to generate estimates of basic research expenditures at disaggregated S/E levels from the 500 to 600 academic R&D performers. A wide range of contacts was made to evoke and discuss all suggestions and comments.

Major Findings:

Existing university computerized record-keeping systems should be used and the basic research expenditures query could be made a part of the annual survey of expenditures for separately budgeted R&D activities if institutions were informed of the needed information sufficiently in advance.

Responsible SRS Organization:

R&D Economic Studies Section/Universities and Nonprofit Institutions Studies Group

Institution/Principal Investigator:

Moshman Associates, Inc.

Availability:

Alternative Strategies for Developing Reliable Estimates of Academic Basic Research Expenditures by Field of Science and Engineering, Final Report, SRS 8114521, August 1982, available from Moshman Associates, Inc., 6400 Goldsboro Road, Bethesda, Maryland 20034 and will also be available from the National Technical Information Service, Springfield, Virginia 22161.

SECTION IV. OUTPUTS AND IMPACTS

A. Innovations and Inventions

Project:

Baseline Survey of Major Academic Research Instruments

Objective:

To develop quantitative indicators of the status of, and need for, equipment for scientific research in U.S. universities and colleges through a nationally representative survey of higher education institutions.

Method:

The contractor will conduct a stratified probability sample of 40 universities from a universe of the approximately 160 largest academic R&D performers. Phase I of the survey will subsample departments within universities in the physical and computer sciences and engineering, collecting information on equipment costing at least $10,000. This study is based on the "Instrumentation Indicators Feasibility Study" completed for NSF by Westat, Inc. in early 1982. The second phase of this projected 3-year study will subsample departments within universities in the biological, agricultural, and environmental sciences.

Major Findings:

NA

Responsible SRS Organization:

R&D Economic Studies Section/Universities and Nonprofit Institutions Studies Group

Institution/Principal Investigator:

Westat, Inc./Lance Hodes

Availability:

Publications resulting from this survey are projected to become available from SRS/Editorial and Inquiries Unit in 1985-87.

Project:

Development of Indicators of Technological Innovation Using Patent Examiners' Citations

Objective:

To develop indicators that differentiate between patents that are significant technically or commercially, and those that are less so.

Method:

Each patent will be weighted by the number of times it is cited by examiners of subsequent patents. All examiner citations associated with patents issued during the 1970-79 period will be tabulated to determine which patents issued during the 1970-77 period were among the most frequently referenced. Interviews will be conducted with patent examiners, and, for a sample of patents, analyses will be made of the complete files. Inventors of a sample of patents will also be interviewed concerning their knowledge of the impact of their invention.

Major Findings:

Phase I of this project has shown that the commercial or technical importance of a patent is likely to be related to the frequency with which it is cited by examiners of subsequently issued patents. Those patents considered important (associated with the "IR 100 Award") were cited two and one-half times more often on the average than the randomly-selected control set. Phase II will include further analysis of the meaning of patents examiners' citations and the relationship between the frequency of citation and extent of commercial use. Patent indicators will be developed for each of 55 product fields.

Responsible SRS Organization:

Science Indicators Unit

Institution/Principal Investigator:

Computer Horizons, Inc./Mark P. Carpenter

Availability:

Development of Refined Indicators of Technology Innovation Using Examiners' Citations in the Patent File--Phase I, National Technical Information Service, Springfield, Virginia 22161, PB 82-101833, $6.50 (paper copy), $3.50 (microfiche); Mark P. Carpenter, Francis Narin, and Patricia Woolf, "Citation Rates to Technologically Important Patents," World Patent Information, Vol. 3, No. 4, 1981, pp. 160-163.

Project:

Examination of New Science and Technology Indicators

Objective:

To examine the feasibility of expanding the collection, analysis, and dissemination of information that can serve as new indicators of industrial innovative activity.

Method:

The investigator will review the literature on models of the innovation process in various sectors and circumstances. After developing a general model, including a preliminary set of indicators, the feasibility of collecting data and information for each of the trial subset of indicators will be examined through interviews with a small number of R&D officials in industrial firms. The information obtained from these discussions will then be used to refine the trial indicators and to identify a small subset. A final test using a mail survey will be conducted and the resulting findings, including the final set of indicators, will be discussed in the final report.

Major Findings:

NA

Responsible SRS Organization:

R&D Economic Studies Section/Industry Studies Group

Institution/Principal Investigator:

Massachusetts Institute of Technology/Christopher T. Hill

Availability:

Expected completion date: summer 1983.

Project:

The Measurement of Industrial Innovation

Objective:

To provide a background study for the planning of Science Indicators--1980, the 13th Annual Report of the National Science Board.

Method:

Selected scholars were commissioned to provide information dealing with the measurement of industrial innovation. These commissioned papers are intended to produce new indicators in this subject area, introduce new interpretations of the data, and suggest areas of future research.

Major Findings:

Whereas technological innovation is of obvious policy interest to the Government, quantitative information on which policy decisions can be based is widely scattered in the professional literature. The commissioned papers attempt to summarize the present state of knowledge, pull together the most significant data in the form of charts and tables, identify trends and make whatever generalizations can be supported by the data, discuss and criticize the various methods employed, and indicate areas in which present knowledge is inadequate.

Responsible SRS Organization:

Science Indicators Unit

Institutions/Principal Investigators:

University of Maine/Thomas D. Duchesneau
Pennsylvania State University/Irwin Feller
Massachusetts Institute of Technology/W. Curtiss Priest and Christopher T. Hill

Availability:

Papers Commissioned as Background for Science Indicators--1980, Volume IV: The Measurement of Industrial Innovation, National Science Foundation; will be available from SRS/Science Indicators Unit, and from the National Technical Information Service, Springfield, Virginia 22161.

Project:

The Measurement of Technological Change

Objective:

To extend the author's previous work so as to develop a method of measuring technological progress. To apply the method to digital computers, farm tractors, and electro-microscopes or similar instruments. To compare the results with those obtained by using other methods.

Method:

For each technology, determine surfaces of constant probability density in terms of the performance variables. Determine the distance between surfaces probabilistically by an application of discriminant functions. This distance represents the amount of progress from one surface to another. Dimensional analysis will be investigated as a way of reducing the number of variables to be studied.

Major Findings:

NA

Responsible SRS Organization:

Science Indicators Unit

Institution/Principal Investigator:

New York University/Prof. Devendra Sahal

Availability:

Final report is expected in fall 1983.

Project:

Measuring Technical Change Through Product Attributes

Objective:

To extend the investigator's previously developed method of measuring the progress of a given technology over time. The method combines the important quantitative features of the technology into a single index. To apply the improved method to jet engines, airframes, and aircraft, and to milling machines.

Method:

An R&D production function, a cost function, a demand function, and a profit function will be developed and then integrated into an overall decision model. Various curve-fitting techniques for estimating the technological trend equation from the model will be studied.

Major Findings:

NA

Responsible SRS Organization:

Science Indicators Unit

Institution/Principal Investigator:

Rand Corporation/Arthur Alexander

Availability:

Final report is expected in fall 1983.

Project:

Measuring Technological Progress Through Tradeoff Surfaces

Objective:

To develop a measure of level of technological performance for technologies that are characterized by more than one performance characteristic to extend an existing method for this purpose. To apply the method to three technologies selected from among computers, farm tractors, liquid fuel, rocket engines, electic generators, or others.

Method:

For each technology, group the devices into sets that are equivalent in performance. Fit each set with a tradeoff surface in multidimensional space. Define a distance measure between the surfaces that will represent the degree of progress from one to another.

Major Findings:

NA

Responsible SRS Organization:

Science Indicators Unit

Institution/Principal Investigator:

University of Dayton/Prof. Joseph P. Martino

Availability:

Final report is expected in 1983.

Project:

Patenting in the United States by Various Countries in Various Fields of Technology

Objective:

To provide current and time-series data on patenting in the United States for 55 product fields and 13 energy technology fields, analyzed by country of origin, sector of patent owner, year of patent application, and year of patent grant.

Method:

Data are based on the computer file of patenting data of the Office of Technology Assessment and Forecast. They are converted from the Patent Office classification system to the Standard Industrial Classification system for 55 product fields, or to a separate classification of energy technologies, by two different computer programs called "concordances."

Major Findings:

Data covering the years 1963-81 show the increasing importance of foreign inventions and some decline in patenting by U.S. industry.

Responsible SRS Organization:

Science Indicators Unit

Institution/Principal Investigator:

Office of Technology Assessment and Forecasts, U.S. Patent and Trademark Office/Jane S. Myers

Availability:

Tabulations titled Indicators of the Patent Output of U.S. Industry (1963-1981) and Energy Patenting 1963-1981 are available for inspection in SRS/Science Indicators Unit.

Project:

Small Business Patenting

Objective:

To develop a method for measuring the rate of patenting by small companies in the United States, and to apply the method to patenting for 1974 and 1980.

Method:

A sample is drawn for each year from those U.S. patents that are assigned to U.S. corporations. Standard directories are used to identify those corporations that are large or medium-sized. By difference, the fraction of patents belonging to small companies can be estimated.

Major Findings:

The method seems to work, though it is excessively labor-intensive. Small business gets a notable share of all corporate patents, but this share, in terms of both the number of small companies patenting, and the number of patents per patenting small company, seems to have dropped from 1974 to 1980.

Responsible SRS Organization:

Science Indicators Unit

Institution/Principal Investigator:

U.S. Patent and Trademark Office/Jane S. Myers

Availability:

Available for inspection in SRS/Science Indicators Unit.

SECTION IV. OUTPUTS AND INPACTS

B. Bibliometrics

Project:

Co-Citation Cluster Development as Science Indicators

Objective:

To develop a new indicator of scientific progress based on co-citation cluster analysis methodologies.

Method:

Co-citation clusters drawn from the Science Citation Index data base are being screened to determine year-to-year continuities. Quantitative characteristics of these clusters are being studied to monitor important developments in research specialties, as reflected in the research literature.

Major Findings:

NA

Responsible SRS Organization:

Science Indicators Unit

Institution/Principal Investigator:

Institute for Scientific Information/H. Roberts Coward

Availability:

Final report is expected in early 1983.

Project:

Cross-National Bibliometric Comparisons

Objective:

To examine differences in the bibliometric characteristics of research papers from different countries, field by field, in order to see if these differences significantly affect the interpretation of current publication and citation indicators.

Method:

Bibliometric analyses will be conducted on publications from 15 countries using the Science Citation Index source tapes. All of the citation data to be used in the cross-country analyses will be developed from the exact-matched citation tapes. The project will provide several new indicators of the output of research including the rapidity of a nation's use of research results in subsequent research, international differences in the use of basic research findings in applied research, and changes report. This project will also test some of the operating assumptions the literature indicators used in the Science Indicators reports.

Major Findings:

NA

Responsible SRS Organization:

Science Indicators Unit

Institution/Principal Investigator:

Computer Horizons, Inc./Francis Narin

Availability:

Final report is expected in fall 1982.

Project:

Developing Models for Assessing the Direct and Indirect Impacts of Sponsored Research and Development at Universities

Objective:

To test the utility of a particular statistical technique (path analysis) for analyzing institutional data to assess the impact of Federal R&D support on various educational outcomes at leading research institutions.

Method:

Path analysis was applied to a sample of 73 institutions that account for over 60% of the R&D expenditures of the total population of universities. The outcome variables used were enrollment, staff size, and degree production for the period 1975-79, as provided by a special data tape produced by National Center for Higher Education Management Systems from data collected by NSF and the National Center for Education Statistics.

Major Findings:

The study demonstrated the utility of applying causal modeling and path analysis to quantitative data in assessing subject effects. Of the selected outcomes, the most significant effects of federally sponsored R&D expenditures generally concerned professional R&D staff size, Ph. D. production, and graduate enrollment (in that order).

Responsible SRS Organization:

R&D Economic Studies Section/Universities and Nonprofit Institutions Studies Group

Institution/Principal Investigator:

Science Management Corporation/David J. Bowering

Availability:

Research Study of the Direct and Indirect Effects of Federally-Sponsored R&D in Science and Engineering at Leading Research Institutions, Final Report, SRS 8018112, December 1981, available from the Science Management Corporation, 1120 Connecticut Avenue, N.W., Suite 200, Washington, D.C. 20030. Vol. I. Executive Summary, National Technical Information Service, Springfield, Virginia 22161, PB 82-239328, $7.50 (paper copy), $4.00 (microfiche), and Vol. II. Final Report, PB 82-239328, $16.00 (paper copy), $4.00 (microfiche).

SECTION IV. OUTPUTS AND IMPACTS

C. Economic Implications

Project:

Indicators of International Technology and Trade Flows

Objective:

To provide background studies of selected areas because of their importance to the planning of Science Indicators--1980, the 13th Annual Report of the National Science Board.

Method:

Selected scholars were commissioned to provide information dealing with the indicators of international technology trade flows. These commissioned papers are intended to produce new indicators in this subject area, examine the adequacy or limitations of existing data, introduce new interpretations of the data, and suggest areas of future research.

Major Findings:

Technological gains by U.S. trading partners, coupled with an increasingly negative U.S. balance of trade, have led to concern that the United States is losing the initiative in technological innovation and that this loss creates a negative impact on our domestic economy and on our relative international economic strength. It was felt that more needs to be known about the ability of our current set of indicators to monitor technology flows adequately, as well as to determine the effects (both positive and negative) of such flows on our national economy.

The papers provide several discussions: (1) Analyses of the relationship between the modes of international technology transfer and the respective indicators; (2) information on new uses or alternative interpretations of existing data in previous Science Indicators reports; (3) an examination of the adequacy or limitations of existing indicators to monitor and describe technology flows; and (4) suggestions of possible new indicators or relevant data for further research needed in this area.

Responsible SRS Organization:

Science Indicators Unit

Institutions/Principal Investigators:

University of Pennsylvania/Edwin Mansfield
Stanford University/Nathan Rosenberg
Developing World Industry & Technology, Inc./Jack Baranson
Harvard University/Raymond Vernon

Availability:

Papers Commissioned as Background for Science Indicators--1980, Vol. I: Indicators of International Technology and Trade Flows, National Science Foundation; available from SRS/Science Indicators Unit; will be available from the National Technical Information Service, Springfield, Virginia 22161.

Project:

The Relationship of Agricultural Research and Development to Selected Socioeconomic Change in the Farm Sector

Objective:

To examine the impact of agricultural research and development on selected characteristics of the U.S. farm sector and to assess the validity and reliability of various agricultural R&D indicators such as expenditure and scientific personnel data.

Method:

The research will focus on possible relationships between research and development and changes in farm commerialization and concentration and in the farm labor force for the Nation as a whole. The project will examine different types of R&D output, levels of effort to diffuse such outputs, and the resultant effects. A comprehensive longitudinal data set will be created for research and development in the agricultural sector for the postwar period (1948-79).

Major Findings:

NA

Responsible SRS Organization:

Science Indicators Unit

Institution/Principal Investigator:

University of Kentucky Research Foundation/Lawrence M. Busch

Availability:

Final report is expected in early 1984.

SECTION IV. OUTPUTS AND IMPACTS

D. Other

Project:

Administrative Responsibilities and the Conduct of Academic Basic Research

Objective:

To provide background studies of areas selected because of their importance to the planning of Science Indicators--1980, the 13th Annual Report of the National Science Board.

Method:

Selected scholars were commissioned to provide information dealing with administrative responsibilities and the conduct of academic basic research. This commissioned paper is intended to produce new indicators in this subject area, introduce new interpretations of the data, and suggest areas of future research.

Major Findings:

There is a growing concern that resources available to scientists for research are being affected now, more than ever before, by administrative responsibilities that draw upon available time and money. The papers address the issue of administrative requirements in two ways: One paper reports results of a case study at a major U.S. research university, and the other reviews types of administrative requirements and discusses their origins.

Responsible SRS Organization:

Science Indicators Unit

Institution/Principal Investigator:

University of Illinois/Herbert S. Gutowski
University of Washington/Joseph L. McCarthy

Availability:

Papers Commissioned as Background for Science Indicators--1980, Vol. III: Administrative Responsibilities and the Conduct of Academic Basic Research; available from SRS/Science Indicators Unit; will be available from the National Technical Information Service, Springfield, Virginia 22161.

Project:

Assessment of Science: The Development and Testing of Indicators of Quality

Objective:

To examine comprehensively a major dimension of science that has not been amenable to the development of indicators, although it is widely felt to be a significant aspect--quality. To explore the conversion of existing quantitative indicators into indicators of the quality of science.

Method:

A year-long series of monthly seminars, coupled with special commissioned papers, will lead to the identification of indicators that will be evaluated by representative scientists and nonscientists. Results will be released in a collection of essays, research papers, and book-length monograph.

Major Findings:

NA

Responsible SRS Organization:

Science Indicators Unit

Institution/Principal Investigator:

Harvard University/Gerald Holton

Availability:

"On Developing Indicators of Quality in Science and Technology," Special Issue of Science, Technology and Human Values, Vol. 7 (Spring and Winter 1982).

Project:

Attitudes of the Attentive Public and Nongovernmental Leadership Toward Science and Technology

Objective:

To produce survey data on the attitudes toward science and technology of opinion leaders in science and technology (S/T) policy outside the Government, and of the portion of the public that is most interested in and informed about S/T issues.

Method:

Two questionnaires will be designed, partly overlapping the one used in the 1979 national survey for Science Indicators. Nationwide surveying will be done by telephone from Northern Illinois University. Responses will be compared with those from the 1979 study.

Major Findings:

NA

Responsible SRS Organization:

Science Indicators Unit

Institution/Principal Investigator:

Northern Illinois University/Jon D. Miller

Availability:

Final report is expected in late 1982.

Project:

Indicators of Interdisciplinary Research

Objective:

To define and begin to measure the extent of interdisciplinary scientific research.

Method:

Definitions and preliminary indicators will be constructed from analyses of the process, product, and usage of research judged to be interdisciplinary. Analyses will be done on articles and authorship teams from six fields: Sociology, psychology, zoology, biochemistry, physics, and electrical engineering. Attempts will be made to develop a formula to identify and quantify interdisciplinary research based on readily available data and a determination of the most salient characteristics of such research.

Major Findings:

NA

Responsible SRS Organization:

Science Indicators Unit

Institution/Principal Investigator:

Georgia Institute of Technology/Daryl E. Chubin, Alan L. Porter, Terry Connolly, and Fredrick A. Rossini

Availability:

Final report is expected in early 1983.

Project:

Instrumentation Indicators Feasibility Study

Objective:

To develop quantitative indicators of the status of, and need for, equipment for scientific research in U.S. universities and colleges.

Method:

Questionnaires were mailed to, and personal interviews conducted with, representatives of 38 institutions that provided sample data on characteristics of items of research equipment within four subdisciplines: Organic chemistry, cell biology, solid state physics, and electrical engineering. The equipment characteristics concerned were the value of equipment, use patterns, obsolescence, and other factors.

Major Findings:

Research instruments costing at least $50,000 (mass spectrometers, electron microscopes, etc.) accounted for more than 70% of the aggregate value of equipment items costing at least $5,000. More than three-fifths of the research equipment purchases in the sample were wholly financed with Federal funds. About one-fourth of the equipment in the subfields studied was at least 10 years old, one-fourth was five to nine years old, and one-half was less than five years old.

Responsible SRS Organization:

R&D Economic Studies Section/Universities and Nonprofit Institutions Studies Group

Institution/Principal Investigator:

Westat, Inc./Lance Hodes

Availability:

"Universities Spent 6% of Separately Budgeted R&D Expenditures for Research Equipment in 1980," Highlights, NSF 82-316, June 14, 1982, available from SRS/Editorial and Inquiries Unit; Indicators of Scientific Research Instrumentation in Academic Institutions: A Feasibility Study, Final Report, SRS 8017873, March 1982, available from Westat, Inc., 1650 Research Boulevard, Rockville, Maryland 20850 and National Technical Information Service, Springfield, Virginia 22161, PB 82-263021, $19.50 (paper copy), $4.00 (microfiche).

Project:

Problems of Small, R&D-Performing Companies

Objective:

To provide some insight into the problems of small, R&D-performing companies.

Method:

A survey of 1,232 small R&D-performing companies was conducted by NSF during 1977, followed by a series of 71 interviews with company officials conducted in 1979 by Economic Associates, Inc. The two-phase project was designed to collect and analyze information on 11 problem areas rated by firms according to importance. Only manufacturing firms with fewer than 500 employees and nonmanufacturing firms with fewer than 100 employees were included in the survey. The information obtained from the interviews was summarized in a report by Economic Associates and an overall study was prepared by NSF based on the 1977 survey and the 1979 interviews.

Major Findings:

The small, high-technology firm performing research and development is considered an important resource for major scientific and technical innovations. Some economists feel that small firms are more efficient than large firms in producing major innovations. The small firm, however, primarily because of its limited resources, is more susceptible to many of the same problems faced by the larger firms. These problems deal with financial, personnel, and regulatory concerns as well as with the transition from research and development to market, high-risk projects, communication, and patenting and licensing. Most of the problems rated were considered important by a large proportion of the surveyed companies. Their composite opinion revealed a narrow differentiation in the rating of many of the problems. All but 1 of the 11 problems--patenting and licensing--were identified as being of major concern by more than 50% of the firms surveyed; 7 areas were identified as major problems by more than 60%. Two-thirds of the firms considered the following four areas to be of major concern: Providing competitive salaries and benefits; maintaining R&D work at adequate levels; dealing with nonprocurement regulations; and obtaining venture and/or working capital.

Responsible SRS Organization:

R&D Economic Studies Section

Institution/Principal Investigator:

Economic Associates, Inc./Frank Piovia

Availability:

Current Problems Facing Small R&D Firms, National Technical Information Service, Springfield, Virginia 22161, PB 80-127830, $6.00 (paper copy), $3.50 (microfiche); Problems of Small, High-Technology Firms, Special Report, NSF 81-305, February 1982, National Technical Information Service, Springfield, Virginia 22161, PB 82-262494, $7.50 (paper copy), $4.00 (microfiche); also available from SRS/Editorial and Inquiries Unit.

Project:

The Relationship of Education, Race, and Gender to General Attitudes and Attentiveness Toward Science and Technology (S/T)

Objective:

To extend the analysis of data from the 1979 survey of public attitudes toward S/T to bring out the effect of specific demographic characteristics of the public.

Method:

Multivariate logit modeling and index construction by computer.

Major Findings:

Support of science increases with education and additionally is more often found among males and nonblacks than among females and blacks. Females are particularly willing to restrict scientific inquiry or to be interested in astrology. Attentiveness to science and technology depends largely on level of education, and moreover is somewhat more frequent among men than women.

Responsible SRS Organization:

Science Indicators Unit

Institution/Principal Investigator:

Northern Illinois University/Jon D. Miller

Availability:

The Relationship of Education, Race, and Gender to Attentiveness to Science and Technology Policy, and The Relationship of Education, Race, and Gender to General Attitudes Toward Science and Technology, September 20, 1981; both reports will be available from the National Technical Information Service, Springfield, Virginia 22161.

Project:

Soviet R&D Statistics

Objective:

To provide current statistics on R&D expenditures and R&D personnel in the Soviet Union.

Method:

Official Soviet data are analyzed at a disaggregated level and made compatible with U.S. data. Soviet scientific personnel data are adjusted to conform to the NSF concept of scientists and engineers employed in research and development. High and low estimates of Soviet R&D scientists and engineers are provided.

Major Findings:

This report updates through 1982 the statistics on Soviet R&D expenditures and manpower presented in two earlier reports: Reference Source on Soviet R&D Statistics, 1950-1978, and Soviet R&D Statistics, 1977-1980. It includes an explanation of the methodology used for developing the statistical data series and provides a full discussion of the rationale for the methodology, as well as uncertainties and limitations associated with the data. Estimates of Soviet R&D expenditures are expressed in terms of dollar cost if the comparable research and development were conducted in the United States. Estimates of the Soviet gross national product are made.

Responsible SRS Organization:

Science Indicators Unit

Institution/Principal Investigator:

Indiana University/Robert W. Campbell

Availability:

Report will be available the National Technical Information Service, Springfield, Virginia 22161, and SRS/Science Indicators Unit in 1983.

Project:

Soviet R&D Statistics, 1977-80

Objective:

To provide updated statistics on R&D investments with particular attention paid to the analysis of science and technology personnel in the Soviet Union.

Method:

Official Soviet data are analyzed at a disaggregated level and made compatible with U.S. data. Soviet scientific personnel data are adjusted to conform to the NSF concept of scientists and engineers employed in research and development. High and low estimates of Soviet R&D scientists and engineers are provided.

Major Findings:

Soviet R&D investments have risen throughout the late seventies and were considerably larger than U.S. investments--both in absolute numbers and in terms of the size of the economy. In 1980 the Soviet Union expended 21.3 billion rubles (or an estimated $104.4) on research and development. This represented 3.47% of their gross national product. Attempts were made to present Soviet science and engineering personnel data comparable to U.S. definitions. A range was provided between high and low estimates that shows that there were between 1.3 and 1.4 million Soviet scientists and engineers engaged in research and development in 1980. The concentration of R&D scientists and engineers in the labor force was the highest of any country: 9-10 R&D scientists and engineers for every 1,000 persons in the labor force.

Responsible SRS Organization:

Science Indicators Unit

Institution/Principal Investigator:

Indiana University/Robert W. Campbell

Availability:

Soviet R&D Statistics, 1977-1980, NSF 80SP0727; National Technical Information Service, Springfield, Virginia 22161, PB 82-207408, $7.50 (paper copy), $4.00 (microfiche); also available from SRS/Science Indicators Unit.

Project:

Structure of Stock-Flow Relationships

Objective:

To develop a conceptual model that describes interrelationships among existing time series on resources for, and outputs from, science and technology.

Method:

Various statistical tools were used to examine relationships among time series identified. Analyses were devised in order to account for stocks and flows, time lags, and similar phenomenon.

Major Findings:

The project concluded that data on science and engineering education were positively related to scientific personnel data and (to a lesser extent) to scientific and technical literature indicators. Industrial R&D expenditures were positively linked with the utilization of resulting technologies. No linkage could be established between R&D expenditures and patents.

Responsible SRS Organization:

Science Indicators Unit

Institution/Principal Investigator:

National Planning Association/Nestor Terleckyj

Availability:

Final report is expected in early 1983.

Project:

U.S. Public Attitudes Toward Science and Technology

Objective:

To determine public attitudes toward science and technology by interviewing a representative sample of the U.S. population 18 years of age and older.

Method:

Multistage area probability sampling. Personal interviewing. Data reduction by computer. Factor analysis, log linear analysis. The work was performed by the Institute for Survey Research, Temple University, and the National Opinion Research Center, University of Chicago.

Major Findings:

The 1979 public generally expressed high support for science and technology. When considering only those whose knowledge and interests include aspects of science and technology, that support is even higher. This trend, coupled with a strong belief among the general public that it has insufficient knowledge about science and technology, points to the importance of science and technology literacy for an informed and participating citizenry. The conceptual development of the "attentive public" is described in detail.

Responsible SRS Organization:

Science Indicators Unit

Institution/Principal Investigator:

Northern Illinois University/Jon D. Miller

Availability:

Attitudes of the U.S. Public Toward Science and Technology, National Technical Information Service, Springfield, Virginia 22161, PB 81-161317, $36.50 (paper copy), $4.00 (microfiche), PB 81-208134 (data tape), $125.00, and PB 81-208142 (codebook), $8.00 (paper copy), $4.00 (microfiche); The Measurement of the Attitudes of the U.S. Public Toward Organized Science, National Technical Information Service, Springfield, Virginia 22161, PB 81-155079, $17.00 (paper copy), $4.00 (microfiche), and The Attitudes of the U.S. Public Toward Science and Technology: Analytic Report, National Technical Information Service, Springfield, Virginia 22161, PB 82-157512, $31.50 (paper copy), $4.00 (microfiche).

APPENDIXES

A. Intramural Publications, 1972-82

B. Extramural Publications, 1972-82

APPENDIXES

A. Intramural Publications, 1972-82

OVERVIEWS

	NSF Number		
	Highlights/ RDSR*	Tables	Full report
National Patterns of Science and Technology Resources			
1983	82-311	-----	
1982	81-314	-----	82-319
1981	80-310	-----	81-311
1980	79-309	-----	80-308
National Patterns of R&D Resources: Funds & Personnel in the United States			
1953-78-79	78-304	-----	78-313
National Patterns of R&D Resources: Funds & Manpower in the United States			
1953-77	77-306	-----	77-310
1953-76	76-309	-----	76-310
1953-75	-----	-----	75-307
1953-74	-----	-----	74-304
1953-73	-----	-----	73-303
1953-72	-----	-----	72-300
Science Indicators			
1980	-----	-----	**NSB 81-1
1978	-----	-----	**NSB 79-1
1976	-----	-----	**NSB 78-1
1974	-----	-----	**NSB 75-1
1972	-----	-----	**NSB 73-1

*Reviews of Data on Science Resources.

**Prepared in the Division of Science Resources Studies for the National Science Board.

	NSF Number		
	Highlights/ RDSR*	Tables	Full report
Science and Engineering Personnel: A National Overview.....	-----	-----	82-318 80-316
U.S. Scientists and Engineers			
1980.....	82-303	82-314	-----
1978.....	80-305	80-304	-----
1976.....	-----	79-305	-----
1974.....	76-312	-----	76-329
The 1972 Scientist and Engineer Population Redefined			
Volume 1. Demographic, Educational, and Professional Characteristics.....	75-305	-----	75-313
Volume 2. Labor Force and Employment Characteristics...	75-326 73-306	76-306	75-327
Academic Science: R&D Funds, Scientists and Engineers, Graduate Enrollment and Support			
1972-81.....	-----	-----	81-326
1972-77.....	-----	-----	80-313

*Reviews of Data on Science Resources.

HUMAN RESOURCES

	NSF Number		
	Highlights/ RDSR*	Tables	Full report
Women and Minorities in Science and Engineering..	-----	-----	82-302 77-304
Racial Minorities in the Scientist and Engineer Population.....	75-314	-----	-----
Characteristics of Doctoral Scientists and Engineers in the United States			
1979.....	81-312	80-323	-----
1977.....	78-316	79-306	-----
1975.....	76-326	-----	77-309
1973.....	76-302 75-310	75-312A	75-312
Characteristics of Experienced Scientists and Engineers			
1976.....	77-322	78-305	-----
Characteristics of the National Sample of Scientists and Engineers			
1974			
Part 1. Demographic and Educational.....	75-305	-----	75-333
Part 2. Employment..	75-317	-----	76-323
Part 3. Geographic..	75-332	-----	76-330

*Reviews of Data on Science Resources.

	NSF Number		
	Highlights/ RDSR*	Tables	Full report
Characteristics of Recent Science/Engineering Graduates			
1980.....	82-320	82-313	-----
Employment Attributes of Recent Science and Engineering Graduates....	80-311	-----	80-325
Employment Patterns of Recent Entrants into Science and Engineering..	78-310	-----	-----
Occupational Mobility of Scientists and Engineers.	-----	-----	80-317
Unemployment Rates and Employment Characteristics for Scientists and Engineers, 1971.....	71-26 71-33	-----	72-307
Scientific Human Resources: Profiles and Issues.....	-----	-----	72-304
Projections of Science and Engineering Doctorate Supply and Utilization			
1982 and 1987.....	-----	-----	79-303
1980 and 1985.....	-----	-----	75-301
Science and Engineering Employment: 1970-80.....	-----	81-310	-----
Current and Future Utilization of Scientific and Technical Personnel in Energy-Related Activities.....	77-315	-----	-----

*Reviews of Data on Science Resources.

	NSF Number		
	Highlights/ RDSR*	Tables	Full report
Federal Scientific and Technical Personnel			
1976, 1977, and 1978...	-----	81-309	-----
Federal Scientific, Technical, and Health Personnel			
1974.....	76-308	-----	-----
1973.....	74-316	-----	-----
1972.....	74-301	-----	-----
1971.....	73-309	-----	-----
Utilization of Science and Engineering Doctorates in Industrial Research and Development.....	78-301	-----	-----
Academic Science: Scientists and Engineers			
January 1981.....	82-312	82-305	-----
January 1980.....	81-315	81-307	-----
January 1979.....	80-309	79-328	-----
Human Resources for Scientific Activities at Universities and Colleges			
January 1978.....	79-315	78-318	-----
Manpower Resources for Scientific Activities at Universities and Colleges			
January 1977.....	77-327	77-321	-----
January 1976.....	76-328	76-321	77-308
January 1975.....	75-331	75-329	76-311
January 1974.....	74-315	75-300A	-----

*Reviews of Data on Science Resources.

	NSF Number		
	Highlights/ RDSR*	Tables	Full report
Resources for Scientific Activities at Universities and Colleges			
1971.....	72-302	-----	72-315
Employment Patterns of Academic Scientists and Engineers, 1973-78.....	-----	-----	80-314
Utilization of Science and Engineering Doctorates in Industrial Research and Development.....	78-301	-----	-----
Scientists, Engineers, and Technicians in Private Industry			
1980.....	-----	81-329	-----
Scientists, Engineers, and Technicians in Manufacturing Industries			
1977.....	79-307	80-306	-----
Scientific and Technical Personnel in Private Industry			
1978-80.....	-----	80-320	-----
1975.....	78-302	-----	-----
1970.....	77-312 72-306	-----	-----
Scientists and Engineers From Abroad			
1976-78.....	-----	80-324	-----
1966-75.....	77-305	-----	-----

*Reviews of Data on Science Resources.

	NSF Number		
	Highlights/ RDSR*	Tables	Full report
Scientists, Engineers, and Physicians From Abroad			
FY 1973	74-302	-----	-----
FY 1972	73-311	-----	-----
FY 1970	71-11	-----	72-312
Immigrant Scientists and Engineers in the United States. A Study of Characteristics and Attitudes	-----	-----	73-302
The Stock of Science and Engineering Master's Degree-Holders in the United States	-----	-----	81-302
Projections of Degrees and Enrollment in Science and Engineering Fields to 1985	-----	-----	76-301
Academic Science: Graduate Enrollment and Support			
Fall 1980	82-306	81-330	-----
Fall 1979	-----	80-321	-----
Fall 1978	79-321	79-316	-----
Graduate Science Education: Student Support and Postdoctorals			
Fall 1977	78-307	78-315	-----
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